# Planning of Water Resources of Rajasthan State

## Report Number:

4.8

## Report Name:

Identification of Projects to be Rehabilitated

Background: Over 2013-2014, a consortium of firms led by Tahal Group produced a set of reports on the subject for the Government of Rajasthan. 9 reports were produced, as follows:

| Report No. | Report Name |
|---|---|
| 4.1 | Hydrology and Weather |
| 4.2 | Basin-wise water availability |
| 4.3 | Catchment area study |
| 4.4 | Groundwater |
| 4.5 | Water pollution |
| 4.6 | Water supply demand |
| 4.7 | Identification of new projects |
| 4.8 | Identification of projects to be rehabilitated |
| 4.9 | Comprehensive water resources plan |

With some exceptions, all the above reports have been uploaded on archive.org and may be found by searching for "Planning of Water Resources of Rajasthan State"

# Final Report No. 4.8

# Volume 1 of 1

# Report

TAHAL GROUP

WAPCOS ISO 9001:2000

INRM Consultants Pvt Ltd

**Final Report No. 4.8**

# Identification of Projects to be Rehabilitated

**September 2014**

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# List of Map

MAP – Existing projects identified for rehabilitation (in back pocket)

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## Abbreviations and Acronyms

| | |
|---|---|
| ACZ | Agro-Climatic Zone |
| CCA | Culturable Command Area |
| CGWB | Central Ground Water Board |
| Cl | Chloride |
| CMLP | Crop-mix Linear Programming |
| CWC | Central Water Commission |
| DC | Distributory Committee |
| EC | Electrical Conductivity |
| EU | European Union |
| ha | Hectare |
| hr | Hour |
| HS | Hydrograph Stations |
| INRM | Indian Natural Resources Management |
| $km^2$ | Square kilometre |
| kWh | Kilowatt hour |
| m | metre |
| $m^2$ | Square metre |
| $m^3$ | Cubic metre |
| Max. | Maximum |
| Mg/l | Milligram/ per litre |
| $m^3/hr$ | Cubic metres per hour |
| $Mm^3$/MCM | Million cubic metres |
| $Mm^3/yr$ | Million cubic metres per year |
| Min. | Minimum |
| mm | millimetre |
| N | North |
| na (or n.a.) | Not applicable, or: Not available |
| NW | Northwest |
| O & M | Operation and Maintenance |
| PC | Project Committee |
| PV | Present value |
| RGWD | Rajasthan Groundwater Department |
| RWSRP | Rajasthan Water Sector Restructuring Project |
| SE | Southeast |
| SW | South-west |
| SWRPD | State Water Resources Planning Department |
| T | Tonne; Transmissivity |
| ToR | Terms of Reference |
| VRB | Village Road Bridge |
| WAPCOS | Water and Power Consultancy Services (India) Ltd. |
| WRPD | Water Resources Planning Department |
| WUA | Water Users Association |
| yr | Year |

# 1. Executive Summary

This report comes as an additional layer of the study, which combines the various data collected and analysed for identification of major and medium projects for rehabilitation and provides an economic perspective and an objective point of view for the decision making stage of prioritizing the rehabilitation of irrigation projects.

As detailed within this report, a systematic process of analysing the water availability and expected economic benefits was conducted in order to enable an objective and unbiased prioritization analysis which leans on economic and social grounds. The economic evaluation is based on the assessment of irrigation benefits derived from the existing irrigation projects pending for rehabilitation, in a way that enables a comprehensive and multi-criteria comparison between them. For that purpose a computational model, The Crop-Mix Linear Programming (CMLP) model was used in order to determine the crop mix which maximizes farm net income under varying constraints on irrigation water availability and then selecting the crop mixes that would give the highest benefits from individual projects, given the project's constraints on availability of water and land and given the expectancy of crop's future farm-gate harvest prices and future yield projections.

On the basis of the CMLP results, a set of economic indicators was calculated for each project individually which enabled a relative ranking between the projects on an objective level, according to the calculated indicators and the main features of the projects, and at the next level a ranking under subjective weights attribution for a multi-criteria prioritization.

Table 1.1 Summary Table: Economic indicators and main features- project wise

| S. No. | Project Name | Class | Benefit/ Cost | | Cost of Water | | CCA | | PV of Investments (per ha) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ratio | Rank | Rs./$m^3$ | Rank | ha | Rank | Rs. | Rank |
| | Set weights "A": Economic benefit approach | | **2** | | **2** | | **1** | | **2** | |
| | Set weights "B": Social approach | | **1** | | **1** | | **1** | | **1** | |
| | A. Improvements in Existing Projects | | Value | Rank | Value | Rank | Value | Rank | Value | Rank |
| 1 | Arwar | Medium | 2.38 | 11 | 0.66 | 16 | 7,394 | 11 | 7,591 | 18 |
| 2 | Badgaon | Medium | 0.95 | 26 | 1.52 | 31 | 6,797 | 12 | 7,056 | 14 |
| 3 | Bagolia | Medium | 0.29 | 35 | 5.44 | 35 | 3,676 | 23 | 7,691 | 24 |
| 4 | Bassi | Medium | 3.86 | 1 | 0.40 | 5 | 3,250 | 26 | 6,202 | 4 |
| 5 | Bhupal sagar | Medium | 0.93 | 27 | 1.32 | 29 | 3,873 | 22 | 9,310 | 26 |
| 6 | Bilas | Medium | 2.34 | 12 | 0.38 | 4 | 5,863 | 16 | 5,725 | 3 |
| 7 | Chandrabhaga | Medium | 1.65 | 19 | 1.29 | 28 | 3,342 | 25 | 7,691 | 21 |
| 8 | Chandsain | Medium | 1.93 | 17 | 0.85 | 19 | 2,600 | 30 | 11,646 | 35 |
| 9 | Chaparwada | Major | 0.78 | 32 | 1.54 | 32 | 11,745 | 6 | 9,793 | 30 |
| 10 | Dheel | Medium | 1.25 | 22 | 1.00 | 25 | 5,943 | 15 | 9,950 | 31 |
| 11 | Dindoli | Medium | 2.96 | 6 | 0.64 | 15 | 2,056 | 34 | 7,146 | 16 |
| 12 | Dugari | Medium | 2.16 | 13 | 0.59 | 13 | 2,251 | 32 | 7,691 | 20 |
| 13 | Galwania | Medium | 3.64 | 2 | 0.53 | 12 | 2,257 | 31 | 8,289 | 25 |
| 14 | Gopalpura | Medium | 0.50 | 34 | 0.28 | 1 | 3,557 | 24 | 6,652 | 10 |

| S. No. | Project Name | Class | Benefit/ Cost | | Cost of Water | | CCA | | PV of Investments (per ha) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ratio | Rank | Rs./$m^3$ | Rank | ha | Rank | Rs. | Rank |
| 15 | Jaisamand | Major | 1.23 | 23 | 0.40 | 7 | 16,000 | 4 | 11,484 | 34 |
| 16 | Jakham | Major | 2.94 | 7 | 0.36 | 2 | 28,308 | 2 | 5,452 | 1 |
| 17 | Kalisil | Medium | 1.21 | 24 | 0.44 | 8 | 4,700 | 18 | 7,691 | 22 |
| 18 | Khari | Medium | 2.70 | 9 | 0.70 | 18 | 6,478 | 13 | 7,591 | 17 |
| 19 | Kothari | Medium | 2.73 | 8 | 0.46 | 9 | 4,395 | 20 | 6,202 | 5 |
| 20 | Lassadia | Medium | 3.27 | 4 | 0.48 | 10 | 2,080 | 33 | 6,652 | 9 |
| 21 | Madhosagar | Medium | 1.78 | 18 | 0.88 | 21 | 3,232 | 27 | 11,398 | 32 |
| 22 | Mahi Bajaj | Major | 2.14 | 15 | 0.40 | 6 | 80,000 | 1 | 9,464 | 27 |
| 23 | Mataji Ka Khera | Medium | 3.13 | 5 | 0.86 | 20 | 3,057 | 28 | 7,691 | 19 |
| 24 | Meja | Major | 1.53 | 20 | 1.07 | 26 | 20,714 | 3 | 6,693 | 12 |
| 25 | Murlia | Medium | 3.44 | 3 | 0.38 | 3 | 1,323 | 35 | 7,146 | 15 |
| 26 | Narain Sagar Jalia | Medium | 0.82 | 31 | 2.39 | 34 | 4,087 | 21 | 7,691 | 23 |
| 27 | Rajsamand | Major | 2.14 | 14 | 0.98 | 24 | 10,450 | 7 | 6,693 | 11 |
| 28 | Sardar Samand | Major | 1.95 | 16 | 0.91 | 22 | 10,325 | 8 | 6,448 | 6 |
| 29 | Sareri | Medium | 0.93 | 28 | 0.95 | 23 | 9,717 | 9 | 5,508 | 2 |
| 30 | Somkagdar | Medium | 0.88 | 29 | 0.49 | 11 | 5,739 | 17 | 6,569 | 8 |
| 31 | Tordi Sager | Major | 0.87 | 30 | 1.50 | 30 | 13,960 | 5 | 9,793 | 29 |
| 32 | Udai Sagar | Medium | 0.73 | 33 | 1.22 | 27 | 4,650 | 19 | 11,411 | 33 |
| 33 | Ummed Sagar | Medium | 1.51 | 21 | 0.67 | 17 | 2,968 | 29 | 9,690 | 28 |
| 34 | Vallabhnagar | Medium | 1.08 | 25 | 1.85 | 33 | 6,464 | 14 | 7,056 | 13 |
| 35 | Wagan | Medium | 2.67 | 10 | 0.60 | 14 | 8,270 | 10 | 6,569 | 7 |

An economic analysis of proposed rehabilitation works for 35 Major and Medium Irrigation projects have been carried out, of which 21 project have Benefit-Cost (B.C.) ratio more than 1.5 having Total Project Cost (Irrigation allocated project cost) Rs. 2,391.85 million and 4 projects have B.C. ratio between 1.5 and 1.0 and Total Project Cost (Irrigation allocated project cost) Rs. 475.54 million. The remaining 10 projects have B.C. ratio less than one and Total Project Capital Cost (Irrigation allocated project cost) is 848.22 million.

Hence, it is recommended to carryout rehabilitation of 25 Major/Medium projects on priority for which B.C. ratio is more than 1.

## 2. Introduction

The largest in the country, Rajasthan covers about 10% geographical area, 5% population, 19% livestock and 14% cultivable area of the country, whereas it holds only 1.16% of the country's surface water. Its 16 river basins (considering the Outside basin) are estimated to yield about 25.38 BCM of surface water (mean availability) and another 18.74 BCM is available as state's shares in trans-boundary river waters under inter-state agreements. The irrigable land available in the state is about 15.7 million hectares requiring 75-100 BCM of water which is not there. Water availability is thus a serious constraint on food production potential of the state. Paradoxically, irrigation efficiencies of the existing projects in the state are reported to be very low varying between 5-43% of the usable water which is much below the national average.

In this report the Consultant has carried out study of 114 major and medium irrigation projects (considering Bhimlat-Abheypura as one and including canal projects having imported surface water) and projects suitable for rehabilitation have been identified.

These projects have been studied with a view to achieve maximum utilization out of all water available at present time and in the future applying the socio economic viability criteria. For this purpose, the consultants have developed specific methodology and tools which are discussed in following sections of the report. Subsequently, the report described the appraisal of the irrigation projects and the determination of actions required in order to improve the existing projects, that make use of surface and ground water.

# 3. Objective

The objective of this report is identification of projects for rehabilitation and/or modernization for existing major and medium projects based on socio economic viability criteria. The methodology for which is described in the next section.

# 4. Methodology

## 4.1 General

The main purpose of the work on irrigation projects are appraisal and economic analysis to establish the need and justification for improvements and modifications in existing projects, to assess the costs involved and prepare the data for prioritization of the improvement plans.

The economic evaluation is based on the assessment of irrigation benefits, and the calculation of economic viability indicators of the irrigation projects, further, social indicators have also been considered in order to enable an unbiased comparison between alternative plans, and hence, prioritizing the projects on socio economic grounds.

## 4.2 Methodology

The total 114 number projects (considering Bhimlat-Abheypura as one and including canal projects having imported surface water) are appraised and project suitable for rehabilitation have been identified, the identified projects have been considered for rehabilitation and detailed appraisal of these identified projects has been carried out.

To facilitate the performance of various computations in the process of appraisal of projects, a project planning worksheet (described in para 4.3 below) has been developed and also a Crop-Mix Linear Programming model (CMLP, described in para 4.4 below) has been developed which aims at finding the crop mix which maximizes farm net income under varying constraints on irrigation water availability.

The computational model analyzes the relation between varying irrigation water supply conditions in the project, in monthly units, and the agricultural production, thus simulating the response of the farmers to irrigation water supply conditions. By changing the water supply conditions by improving the performance of existing projects and computing the resulting changes in agricultural production and farm income, it is possible to assess the economic viability of improvement plans.

## 4.3 Project Planning Sheet

To facilitate the performance of various computations in the process of appraising projects and formulating a plan for improvements, a project planning worksheet has been devised as an Excel electronic spreadsheet (see Annex 2). Sample worksheet of Arwar project is presented in Annex 4.

This computational aid was also designed to be linked with the crop-mix linear programming (CMLP) model described below, as explained in Annex 2.

All the input data, and the results related to the economic analysis performed with these data, must be given for two scenarios - with and without the plan being considered with respect to improvement and modifications in existing projects.

All the time-related input data and results are in annual terms, unless otherwise indicated, specified for four Planning Stages: present (2010), year 2020, year 2040 and year 2060. The detail of the Project planning sheets are discussed in Annex 2.

## 4.4 CMLP Model

A simplified linear programming (LP) procedure was developed by the Consultant for selecting the crop mixes that would give the highest benefits from individual projects, given the project's constraints on availability of water and land. The program includes crop production, income and cost data representing different regions, agro-climatic conditions and climatic states, as well as the amount of culturable command area (CCA) and water availability conditions in the analyzed project.

Calculation of the net benefits is dependent on the salient features of the projects. The main inputs (and constraints) are detailed here under:

### 4.4.1 Data

Water supply and demand: water supply, surface water from reservoirs, surface water by pumping from the run of the river ("Lift irrigation"), groundwater, water demand by crops, land supply and demand.

### 4.4.2 Crop constraints

Available irrigable land, land occupancy by crops, special constraints on crop areas, crop calendar, total investments per hectare, farm income, and total net income.

The response of the farming community to various water availability conditions involves decision making under uncertainty with regard to climatic conditions. To analyze the response of farmers to irrigation water conditions under uncertainty, it is assumed that the climatic probability distribution is represented by four climatic states, or dependabilities, each assigned a probability of occurrence. The four climatic states are denoted in the computational model by State1, State2, State3 and State4, corresponding to dependabilities of 90%, 75%, 50% and 25%. It is further assumed that, based on past experience, the probabilities, or weights, of the climatic states are known, and the objective is to maximize the mean, or weighted average, of farm incomes. Accordingly, the model includes four sets of water supply conditions, corresponding to the four climatic states with their four probabilities, or weights. The main variables to be determined by the model are four sets of cropped areas, corresponding to the four irrigation water conditions related to the four climatic states.

There are two main cropping seasons, namely Rabi and Kharif. For the Rabi season, at the time of deciding on crop sowing most of the rain has already fallen, the amount of water available for irrigation from the project's storage reservoir is known in advance, and the decision on Rabi crops is a decision under certainty. Only small amounts of rain are expected during the growing season itself, and for practical purposes the water requirement of the sown Rabi crops does not depend on the rainfall during the season.

On the other hand, both the supply and the demand for irrigation water for Kharif crops depend on the climatic conditions during the cropping season. The degree of certainty existing at the time of decision making on the Kharif crops, with respect to the water supply conditions, depends on the type of water source. Depending on the degree of certainty, in some cases there would be only one set of selected Kharif crop areas common to all four climatic states, while in other cases there would be four sets. This follows from the approach adopted with regard to uncertainty as discussed in the next paragraph.

As the decision on Rabi crops is made under conditions of certainty, and since it is of interest on its own, a special application of the model was formulated for this purpose, which can be viewed as a sub-model of the more general LP model. It is different from the general model in that it contains only one set of known water supply conditions and one set of crop area variables. Further details of the CMLP model are given in Annex 3.

## 4.5 Crops' income per hectare projections

A significant importance was given to the net farm income derived from the additional agricultural activity. In order to assess the expected benefits due to an improved agricultural project, a net income per hectare projection was conducted to each of the agro-climatic zone and for each of the crop which was included in the ACZ's cropping pattern.

The projected net income per hectare is fully dependent on the expected yield of the various crops in each ACZ, the costs of cultivation and the future farm gate prices in each of the future time points (present time 2010, 2020, 2040, 2060). A long term farm gate prices projection is affected by numerous variables that make it somewhat uncertain to predict, and in order to overcome this uncertainty, the long term median prices were used to reflect the mean expected future farm gate prices.

The methodology used was to adjust the current published prices with the index of farm harvest prices (all crops), excluding abnormal observations. The assumption is that occurrences of events influencing farm harvest prices recur on a certain cycle; hence a long term median price already reflects such recurrences. The farm harvest prices for various crops from 1995-96 to 2009-10 are given in Table 4.1 further adjusted with the index of farm harvest prices.

Using the values of Table 4.1, medium harvest prices for major crops were estimated as shown in Table 4.2 and Figure 4.1 to 4.13.

Table 4.1 Farm harvest prices

| | | | 1995-96 | 1996-97 | 1997-98 | 1998-99 | 1999-00 | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rs. Per Quintal in current prices | Soybean | 1 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 1,326 | 1,406 | 1,401 | 1,141 | 1,232 | 1,963 | 2,183 | 2,103 |
| | Coriander (Dhania Bold) | 2 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 2,254 | 2,047 | 1,519 | 1,985 | 2,322 | 4,421 | 4,623 | 3,502 |
| | Cumin seed | 3 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 6,951 | 5,759 | 6,431 | 6,005 | 7,652 | 9,225 | 9,991 | 10,385 |
| | Isabgol | 4 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 1,914 | 2,207 | 2,781 | 2,729 | 3,818 | 4,636 | 4,571 |
| | Onion | 5 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 320 | 332 | 312 | 443 | 661 | 764 | 884 | 884 |
| | Bajra | 6 | 424 | 427 | 393 | 414 | 584 | 426 | 358 | 557 | 427 | 520 | 609 | 690 | 663 | 709 | 902 |
| | Maize | 7 | 408 | 461 | 418 | 459 | 515 | 521 | 438 | 588 | 469 | 535 | 569 | 751 | 787 | 751 | 967 |
| | Groundnut | 8 | 1,290 | 1,209 | 1,081 | 1,365 | 1,289 | 1,358 | 1,255 | 1,550 | 1,589 | 1,662 | 1,626 | 1,955 | 2,315 | 2,153 | 2,750 |
| | Cotton | 9 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 1,942 | 2,463 | 1,757 | 1,760 | 1,920 | 2,384 | 2,634 | 3,019 |
| | Wheat | 10 | 451 | 579 | 535 | 596 | 651 | 629 | 649 | 666 | 674 | 731 | 823 | 940 | 1,028 | 1,113 | 1,196 |
| | Barley | 11 | 380 | 483 | 420 | 476 | 563 | 433 | 488 | 534 | 521 | 563 | 684 | 699 | 993 | 1,005 | 1,007 |
| | Gram | 12 | 857 | 1,160 | 986 | 1,173 | 1,207 | 1,644 | 1,520 | 1,548 | 1,370 | 1,406 | 1,925 | 2,117 | 2,337 | 2,336 | 3,686 |
| | Mustard | 13 | 1,068 | 1,132 | 1,328 | 1,250 | 1,224 | 1,424 | 1,285 | 1,749 | 1,872 | 1,563 | 1,499 | 1,766 | 2,451 | 2,297 | 2,305 |
| Index of farm harvest prices- all crops (1995-2006 index) | | | 310 | 366 | 342 | 382 | 413 | 424 | 408 | 459 | 438 | 460 | 529 | - | - | - | - |
| Index of farm harvest prices- all crops (2006-2010 index) (2010 prices) | | | 112 | 133 | 124 | 138 | 150 | 154 | 148 | 166 | 158 | 166 | 191 | 220 | 256 | 270 | 287 |
| Adjustment Coefficient | | | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Rs. Per Quintal in real prices | Soybean | 1 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 2,294 | 2,551 | 2,419 | 1,714 | 1,610 | 2,204 | 2,324 | 2,103 |
| | Coriander (Dhania Bold) | 2 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 3,899 | 3,715 | 2,623 | 2,982 | 3,034 | 4,964 | 4,922 | 3,502 |
| | Cumin seed | 3 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 12,024 | 10,451 | 11,103 | 9,021 | 9,998 | 10,358 | 10,637 | 10,385 |
| | Isabgol | 4 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 3,473 | 3,810 | 4,178 | 3,566 | 4,287 | 4,936 | 4,571 |
| | Onion | 5 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 554 | 602 | 539 | 665 | 864 | 858 | 941 | 884 |
| | Bajra | 6 | 1,086 | 925 | 911 | 861 | excluded | 798 | 696 | 963 | 775 | 898 | 915 | 902 | 744 | 755 | 902 |
| | Maize | 7 | 1,044 | 1,000 | 971 | 955 | 990 | 974 | 853 | 1,017 | 851 | 924 | 855 | 981 | 884 | 800 | 967 |
| | Groundnut | 8 | 3,304 | 2,620 | 2,508 | 2,839 | 2,478 | 2,542 | 2,443 | 2,681 | 2,883 | 2,869 | 2,443 | 2,554 | 2,599 | 2,292 | 2,750 |
| | Cotton | 9 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 3,359 | 4,469 | 3,033 | 2,644 | 2,509 | 2,677 | 2,804 | 3,019 |
| | Wheat | 10 | 1,155 | 1,255 | 1,242 | 1,241 | 1,252 | 1,178 | 1,263 | 1,152 | 1,223 | 1,262 | 1,237 | 1,228 | 1,154 | 1,185 | 1,196 |
| | Barley | 11 | 972 | 1,047 | 975 | 991 | 1,083 | 810 | 950 | 923 | 945 | 972 | 1,027 | 913 | 1,115 | 1,070 | 1,007 |
| | Gram | 12 | 2,195 | 2,514 | 2,288 | 2,440 | 2,320 | 3,077 | 2,959 | 2,678 | 2,486 | 2,427 | 2,892 | 2,766 | 2,624 | 2,487 | 3,686 |
| | Mustard | 13 | 2,737 | 2,454 | 3,082 | 2,600 | 2,352 | 2,664 | 2,501 | 3,025 | 3,397 | 2,699 | 2,252 | 2,307 | 2,752 | 2,445 | 2,305 |

Source: Agricultural Statistics of Rajasthan 2009-10.

Table 4.2 Median harvest prices for major crops in Rajasthan

| S. No. | Crop | Median harvest prices (Rs. per quintal in real prices) |
|---|---|---|
| 1 | Soybean | 2,249.00 |
| 2 | Coriander (Dhania Bold) | 3,608.30 |
| 3 | Cumin seed | 10,417.80 |
| 4 | Isabgol | 4,177.70 |
| 5 | Onion | 761.70 |
| 6 | Bajra | 897.80 |
| 7 | Maize | 967.00 |
| 8 | Groundnut | 2,599.40 |
| 9 | Cotton | 2,911.60 |
| 10 | Wheat | 1,228.20 |
| 11 | Barley | 975.30 |
| 12 | Gram | 2,514.40 |
| 13 | Mustard | 2,600.30 |

Figure 4.1 Major crops' harvest prices in real terms (Rs. Per Quintal)- Bajra

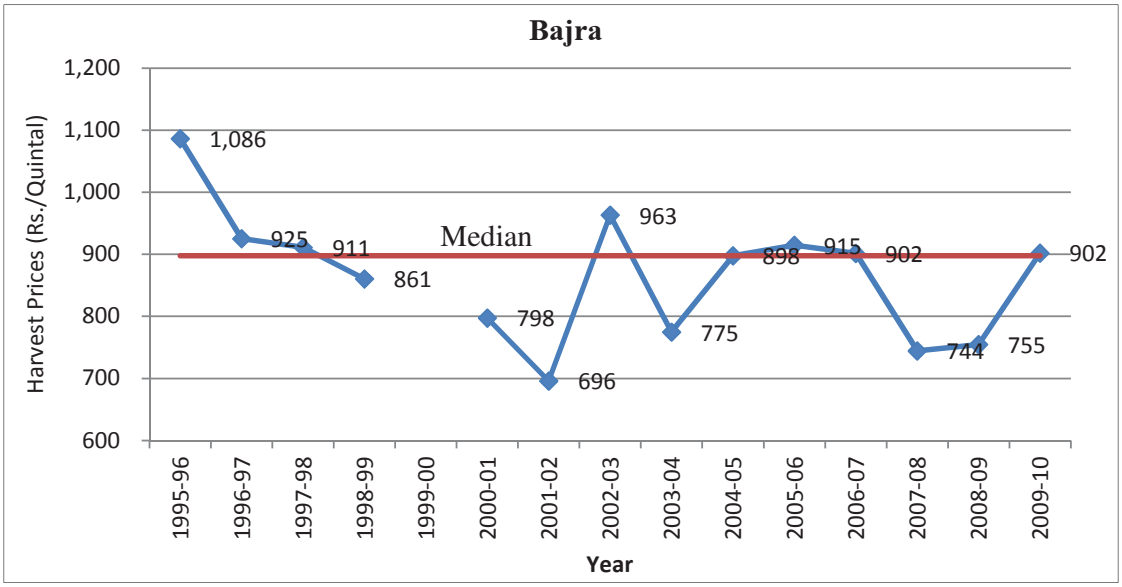


Figure 4.2 Major crops' harvest prices in real terms (Rs. Per Quintal)- Maize

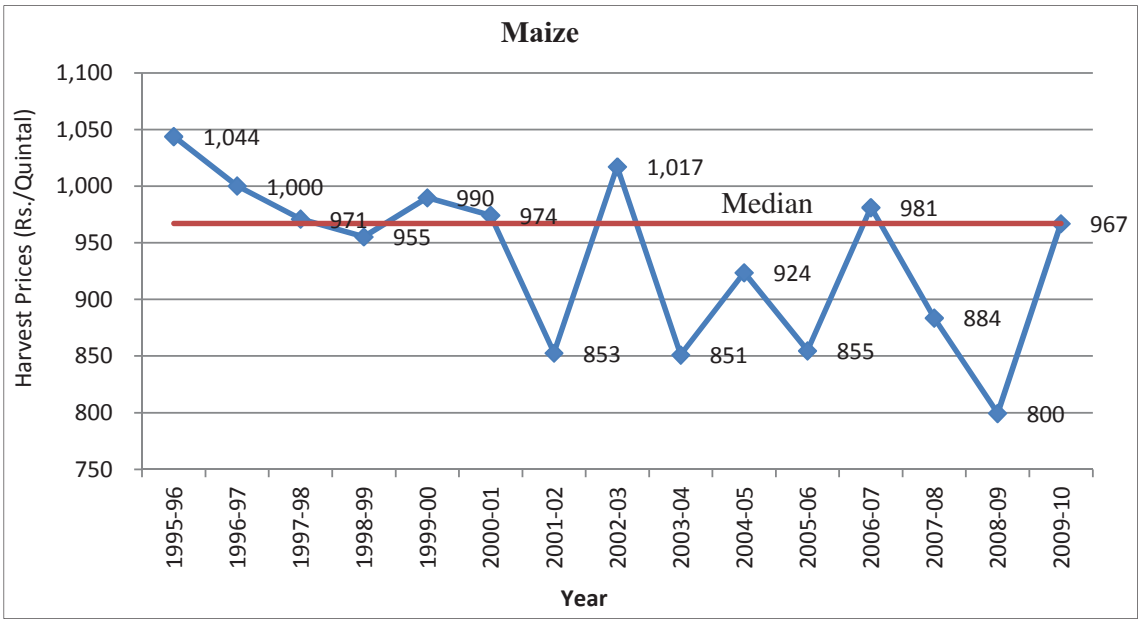



Figure 4.3 Major crops' harvest prices in real terms (Rs. Per Quintal)- Groundnut

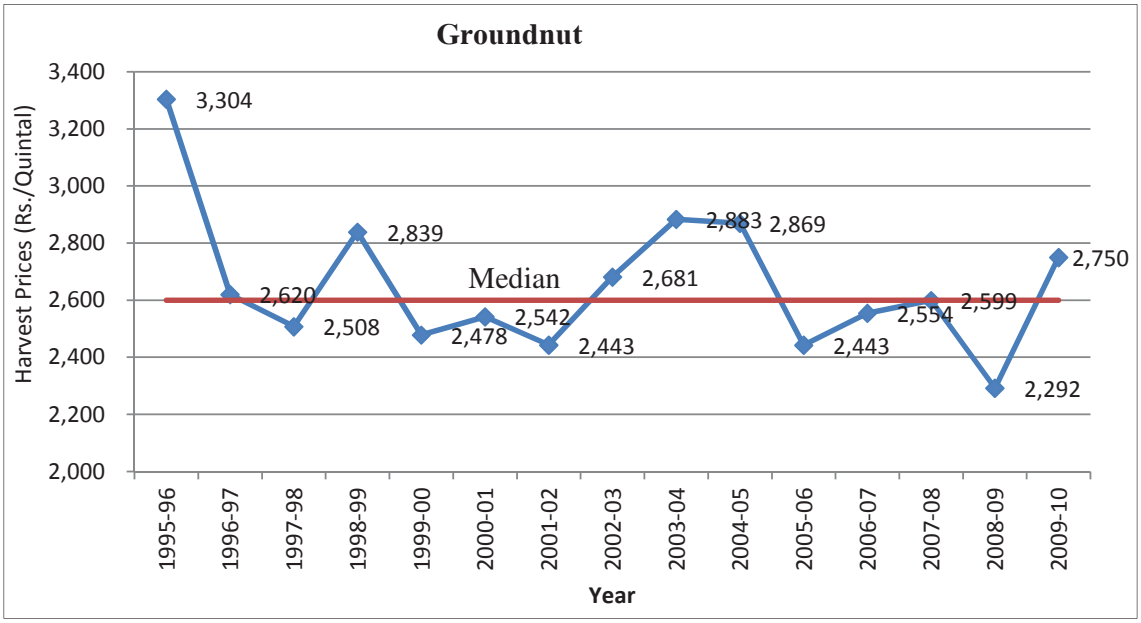


Figure 4.4 Major crops' harvest prices in real terms (Rs. Per Quintal)- Cotton

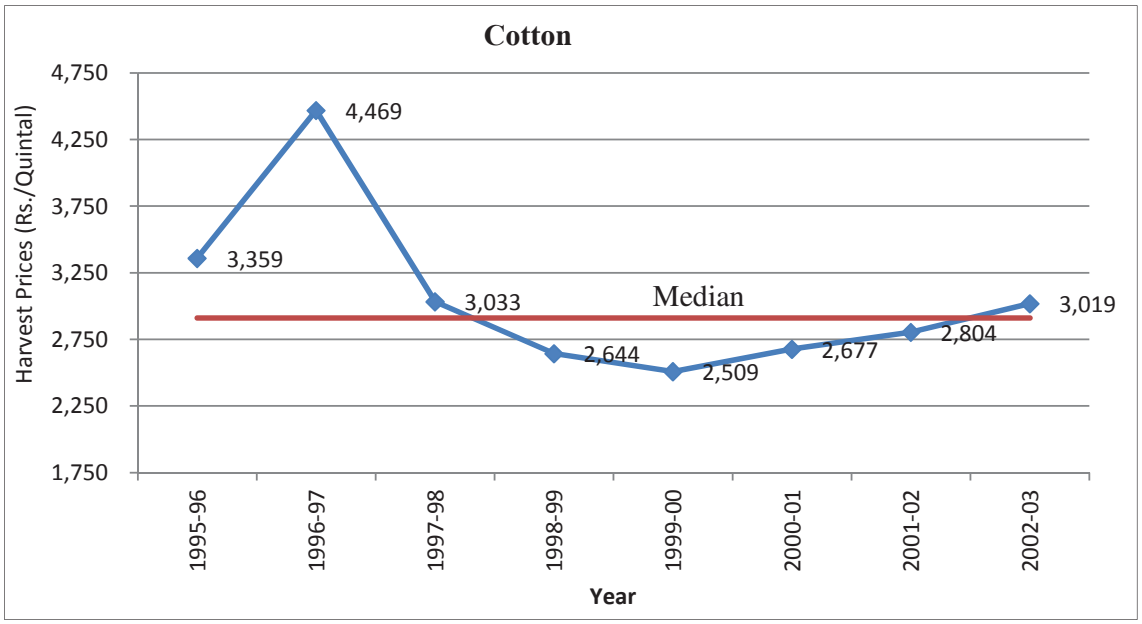



Figure 4.5 Major crops' harvest prices in real terms (Rs. Per Quintal)- Wheat

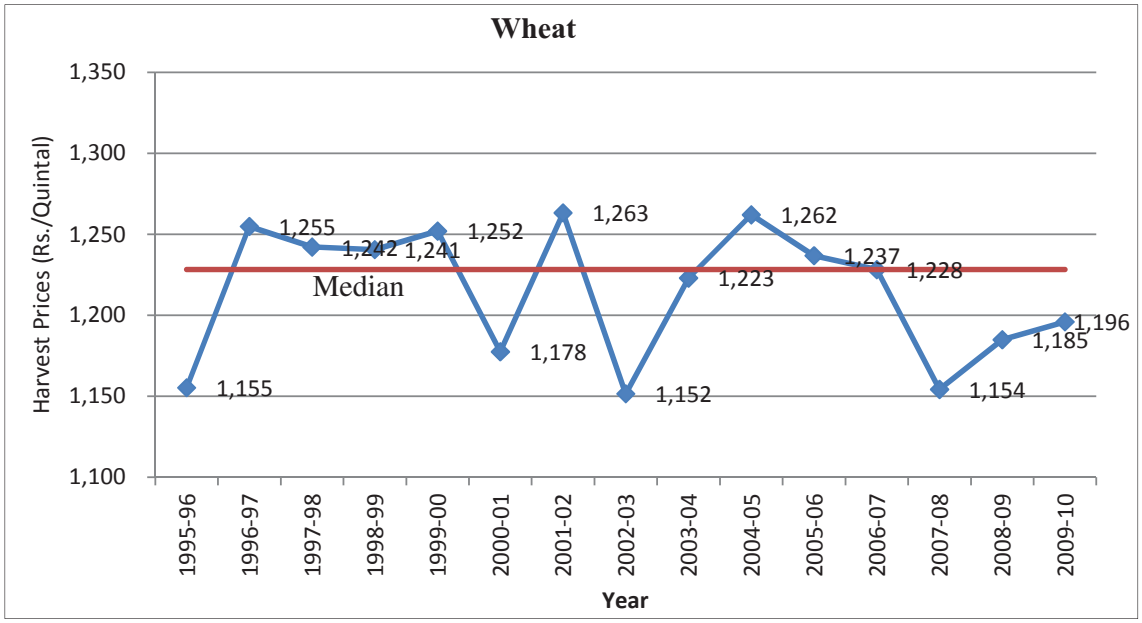


Figure 4.6 Major crops' harvest prices in real terms (Rs. Per Quintal)- Barley

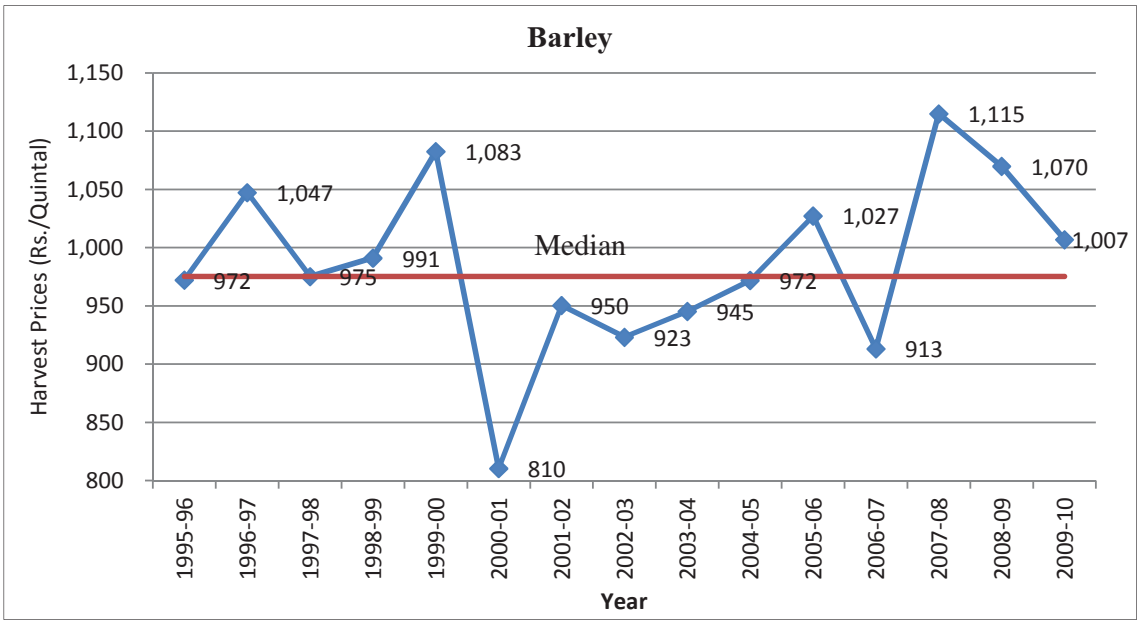



Figure 4.7 Major crops' harvest prices in real terms (Rs. Per Quintal)- Mustard

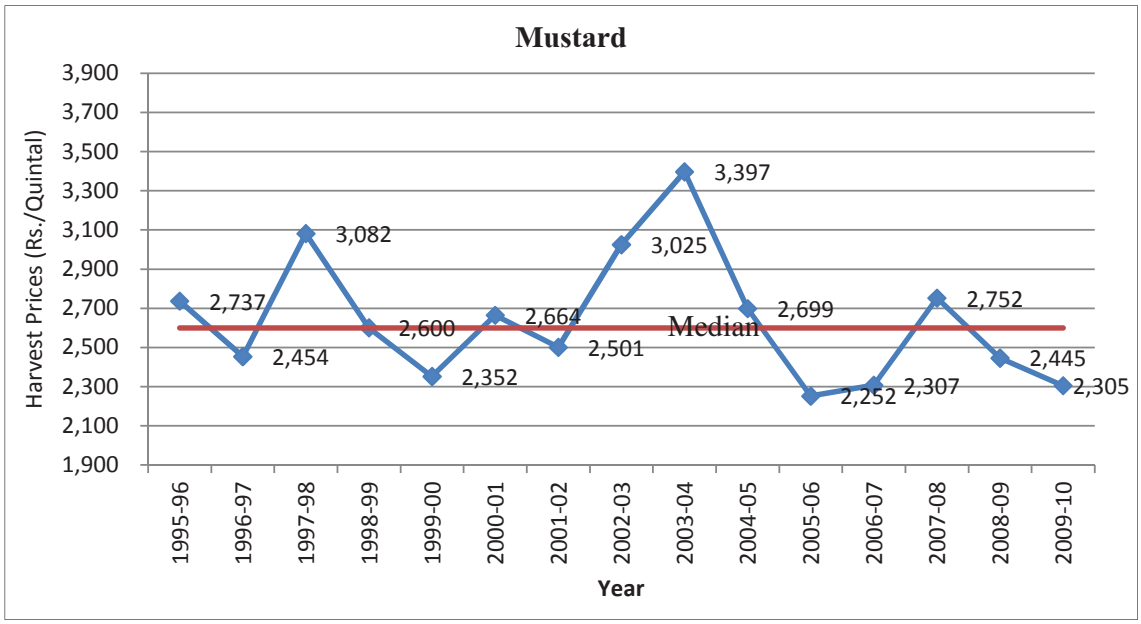


Figure 4.8 Major crops' harvest prices in real terms (Rs. Per Quintal)- Gram

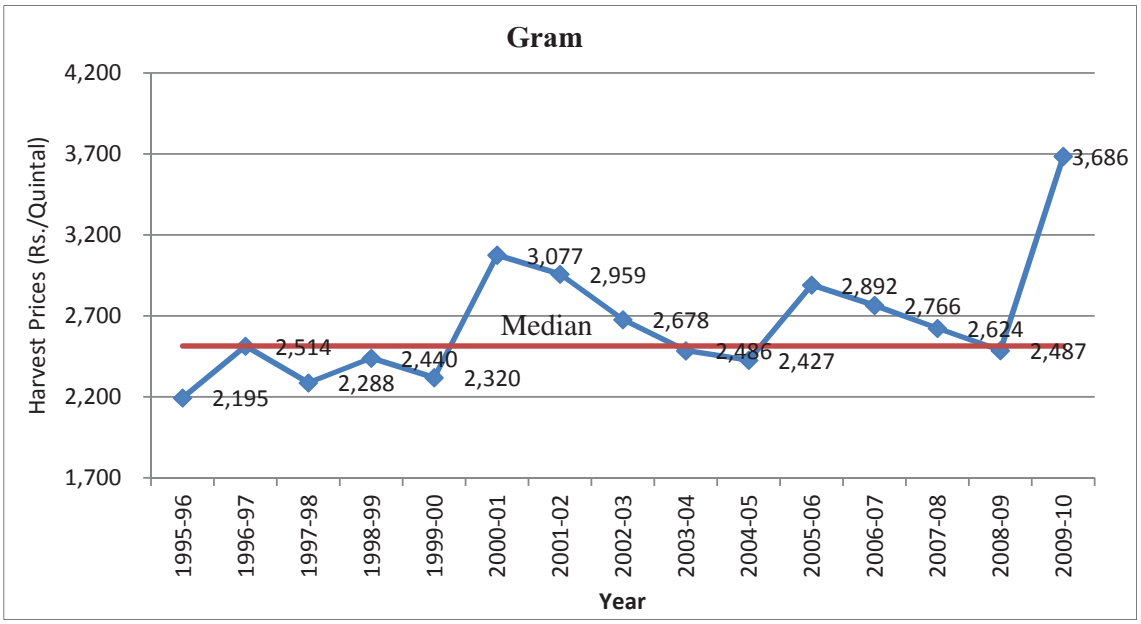



Figure 4.9 Major crops' harvest prices in real terms (Rs. Per Quintal)- Soybean

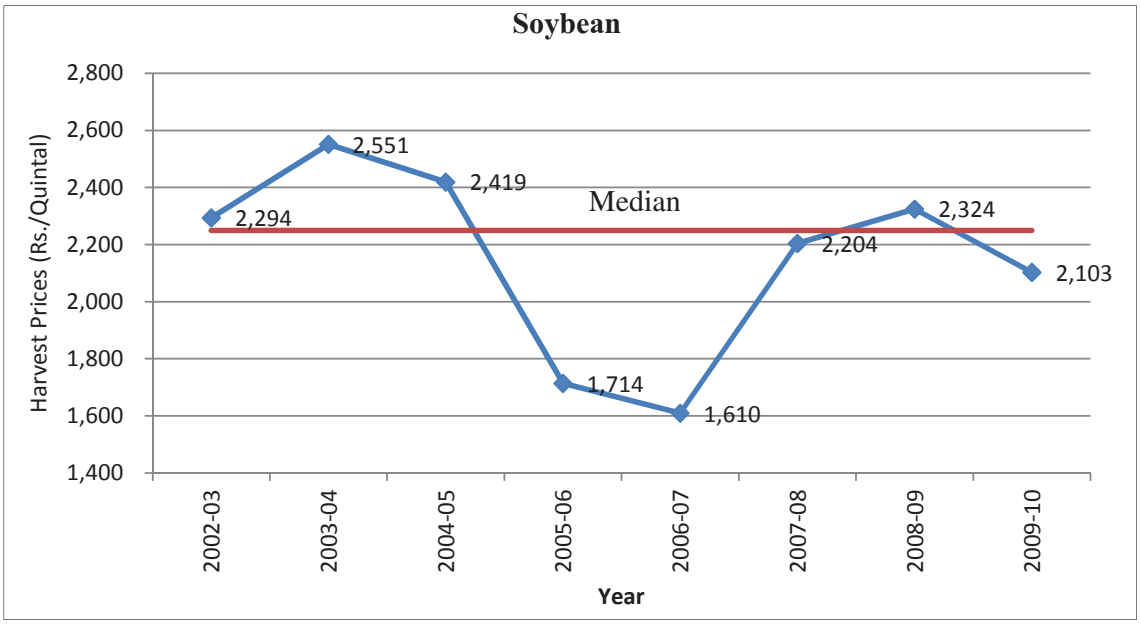


Figure 4.10 Major crops' harvest prices in real terms (Rs. Per Quintal)- Coriander

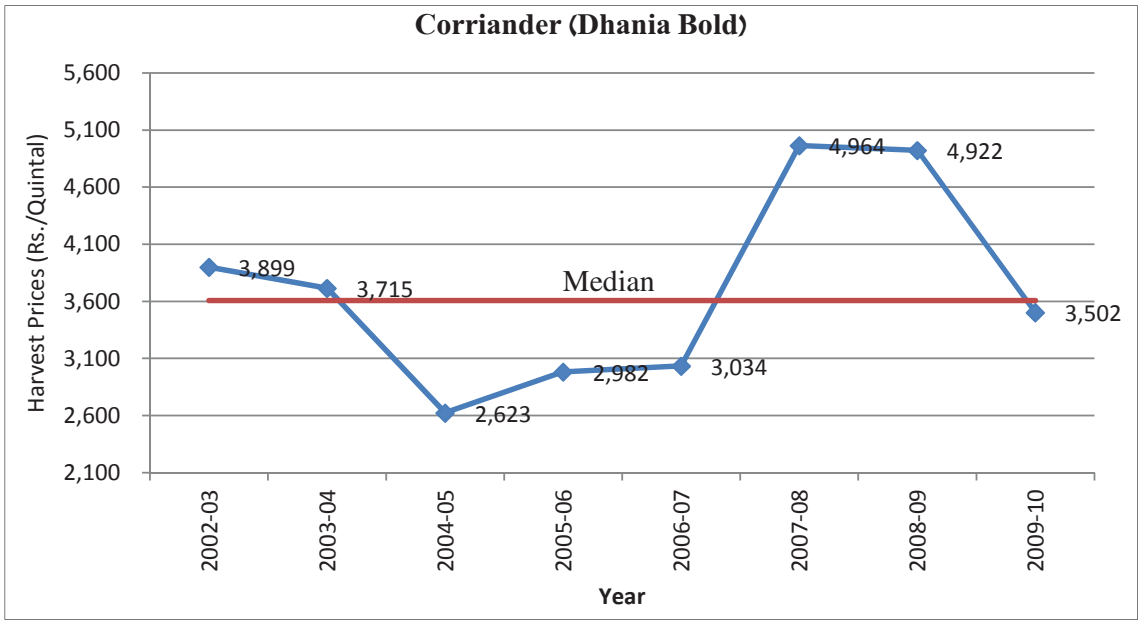



Figure 4.11 Major crops' harvest prices in real terms (Rs. Per Quintal)- Isabgol

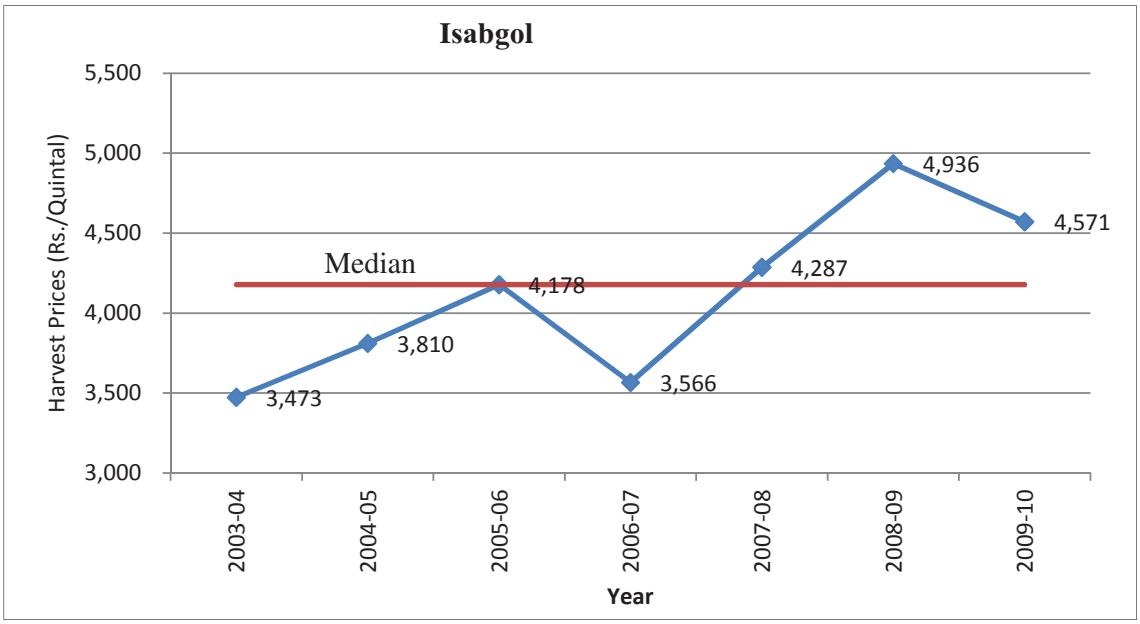


Figure 4.12 Major crops' harvest prices in real terms (Rs. Per Quintal)- Cumin

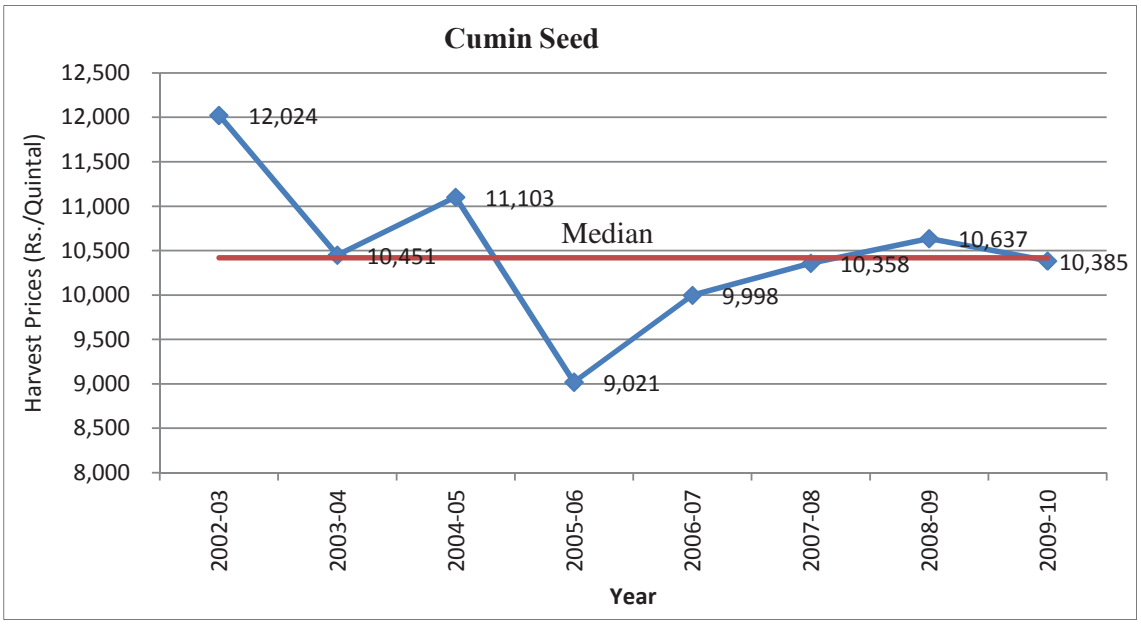
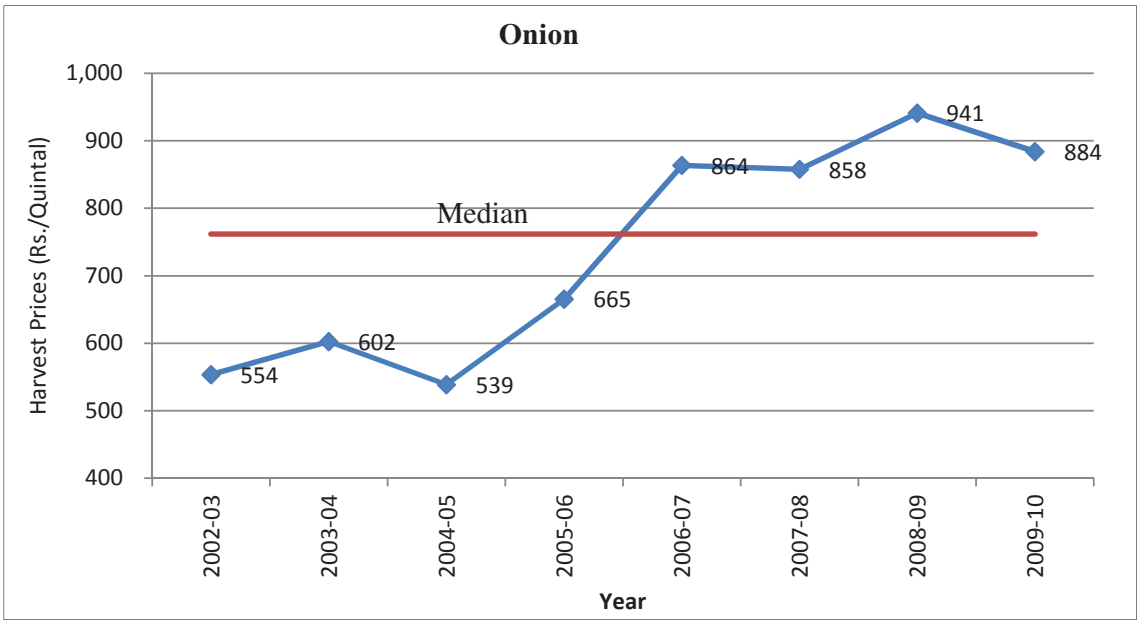



Figure 4.13 Major crops' harvest prices in real terms (Rs. Per Quintal)- Onion




After analysing the projected crop harvest prices and multiplying the total expected yield in each of the four time points (present day, 2020, 2040, 2060) with the median expected price, the ACZ's costs of cultivation were subtracted from the total income, hence presenting the expected net total income per hectare.

Table 4.3 Projected net income per hectare ACZ wise

| ACZ | IIb | | | | Cost of Cultivation (Rs. / ha) | Income- Median Farm Gate Price (Rs. Per kg) | | | | Net Income Rs./ ha | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Productivity kg per ha | | | | | | | | | | | | |
| Crop | 2010 | 2020 | 2040 | 2060 | | 2010 | 2020 | 2040 | 2060 | 2010 | 2020 | 2040 | 2060 |
| Bajra | 954 | 1,020 | 1,151 | 1,629 | 6,555 | 8.978 | 8.978 | 8.978 | 8.978 | 2,010 | 2,602 | 3,778 | 8,070 |
| Maize | 1,714 | 1,962 | 2,458 | 2,956 | 8,505 | 9.670 | 9.670 | 9.670 | 9.670 | 8,069 | 10,468 | 15,264 | 20,080 |
| Groundnut | 1,626 | 1592 | 1524 | 1458 | 15485 | 25.994 | 25.994 | 25.994 | 25.994 | 26781 | 25897 | 24130 | 22414 |
| Wheat | 2,010 | 2,394 | 3,263 | 4,475 | 17,990 | 12.282 | 12.282 | 12.282 | 12.282 | 6,697 | 11,413 | 22,086 | 36,972 |
| Mustard | 1,230 | 1,260 | 1,319 | 1,468 | 9,400 | 26.003 | 26.003 | 26.003 | 26.003 | 22,584 | 23,364 | 24,898 | 28,772 |
| Cumin | 324 | 318 | 297 | 285 | 15,600 | 104.178 | 104.178 | 104.178 | 104.178 | 18,154 | 17,529 | 15,341 | 14,091 |
| Isabgol | 597 | 298 | - | - | 11,980 | 41.771 | 41.771 | 41.771 | 41.771 | 12,961 | 469 | - | - |
| ACZ | IIIa | | | | Cost of Cultivation (Rs. / ha) | Income- Median Farm Gate Price (Rs. Per kg) | | | | Net Income Rs./ ha | | | |
| | Productivity kg per ha | | | | | | | | | | | | |
| Crop | 2010 | 2020 | 2040 | 2060 | | 2010 | 2020 | 2040 | 2060 | 2010 | 2020 | 2040 | 2060 |
| Bajra | 1,389 | 1,468 | 1,626 | 1,803 | 6,415 | 8.978 | 8.978 | 8.978 | 8.978 | 6,055 | 6,764 | 8,183 | 9,772 |
| Maize | 1,459 | 1,360 | 1,320 | - | 8,640 | 9.670 | 9.670 | 9.670 | 9.670 | 5,469 | 4,511 | 4,124 | - |
| Groundnut | 1810 | 1885 | 2034 | 2303 | 16890 | 25.994 | 25.994 | 25.994 | 25.994 | 30159 | 32109 | 35982 | 42974 |
| Cotton | 1,368 | 1,512 | - | - | 20,940 | 29.116 | 29.116 | 29.116 | 29.116 | 18,891 | 23,084 | - | - |
| Barley | 3,147 | 3,240 | 4,285 | 5,329 | 13,655 | 9.753 | 9.753 | 9.753 | 9.753 | 17,037 | 17,944 | 28,136 | 38,318 |
| Wheat | 3,491 | 3,664 | 4,987 | 6,003 | 17,150 | 12.282 | 12.282 | 12.282 | 12.282 | 25,726 | 27,851 | 44,100 | 56,579 |
| Mustard | 1,478 | 1,392 | 1,220 | 1,047 | 10,300 | 26.003 | 26.003 | 26.003 | 26.003 | 28,132 | 25,896 | 21,424 | 16,925 |
| ACZ | IIIb | | | | Cost of Cultivation (Rs. / ha) | Income- Median Farm Gate Price (Rs. Per kg) | | | | Net Income Rs./ ha | | | |
| | Productivity kg per ha | | | | | | | | | | | | |
| Crop | 2010 | 2020 | 2040 | 2060 | | 2010 | 2020 | 2040 | 2060 | 2010 | 2020 | 2040 | 2060 |
| Gram | 1,425 | - | - | - | 10,395 | 25.144 | 25.144 | 25.144 | 25.144 | 25,435 | - | - | - |
| Bajra | 1,860 | 1,911 | 2,290 | 2,561 | 6,710 | 8.978 | 8.978 | 8.978 | 8.978 | 9,989 | 10,447 | 13,849 | 16,282 |
| Cotton | 1886 | 1953 | 2084 | 2214 | 20940 | 29.116 | 29.116 | 29.116 | 29.116 | 33959 | 35924 | 39724 | 43523 |
| Barley | 3,465 | - | - | - | 13,780 | 9.753 | 9.753 | 9.753 | 9.753 | 20,013 | - | - | - |
| Wheat | 4,143 | 4,267 | 4,516 | 4,828 | 15,985 | 12.282 | 12.282 | 12.282 | 12.282 | 34,899 | 36,422 | 39,481 | 43,312 |
| Mustard | 1,718 | 1,686 | 1,622 | 1,556 | 10,296 | 26.003 | 26.003 | 26.003 | 26.003 | 34,377 | 33,545 | 31,881 | 30,165 |

| ACZ | IVa | | | | Cost of Cultivation (Rs. / ha) | Income- Median Farm Gate Price (Rs. Per kg) | | | | Net Income Rs./ ha | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Productivity kg per ha | | | | | 2010 | 2020 | 2040 | 2060 | 2010 | 2020 | 2040 | 2060 |
| Crop | 2010 | 2020 | 2040 | 2060 | | | | | | | | | |
| Maize | 1,747 | 1,781 | 1,850 | 2,002 | 10,625 | 9.670 | 9.670 | 9.670 | 9.670 | 6,268 | 6,597 | 7,265 | 8,734 |
| Barley | 2,312 | 2,604 | - | - | 13,655 | 9.753 | 9.753 | 9.753 | 9.753 | 8,893 | 11,741 | - | - |
| Wheat | 3077 | 3406 | 4148 | 4796 | 16800 | 12.282 | 12.282 | 12.282 | 12.282 | 20992 | 25032 | 34146 | 42104 |
| Gram | 946 | 988 | 1,143 | - | 10,950 | 25.144 | 25.144 | 25.144 | 25.144 | 12,836 | 13,892 | 17,790 | - |
| Cotton | 2,196 | 1,665 | - | - | 16,670 | 29.116 | 29.116 | 29.116 | 29.116 | 47,269 | 31,808 | - | - |
| Mustard | 1,386 | 1,374 | 1,350 | 1,326 | 10,884 | 26.003 | 26.003 | 26.003 | 26.003 | 25,156 | 24,844 | 24,220 | 23,596 |
| **ACZ** | **IVb** | | | | **Cost of Cultivation (Rs. / ha)** | **Income- Median Farm Gate Price (Rs. Per kg)** | | | | **Net Income Rs./ ha** | | | |
| | **Productivity kg per ha** | | | | | **2010** | **2020** | **2040** | **2060** | **2010** | **2020** | **2040** | **2060** |
| **Crop** | **2010** | **2020** | **2040** | **2060** | | | | | | | | | |
| Cotton | 1,665 | 1,814 | 2,097 | 2,381 | 15,990 | 29.116 | 29.116 | 29.116 | 29.116 | 32,488 | 36,812 | 45,067 | 53,321 |
| Wheat | 2,016 | 2,253 | 2,374 | 2,454 | 18,990 | 12.282 | 12.282 | 12.282 | 12.282 | 5,771 | 8,681 | 10,167 | 11,150 |
| Gram | 901 | 1051 | - | - | 11200 | 25.144 | 25.144 | 25.144 | 25.144 | 11455 | 15227 | - | - |
| **ACZ** | **V** | | | | **Cost of Cultivation (Rs. / ha)** | **Income- Median Farm Gate Price (Rs. Per kg)** | | | | **Net Income Rs./ ha** | | | |
| | **Productivity kg per ha** | | | | | **2010** | **2020** | **2040** | **2060** | **2010** | **2020** | **2040** | **2060** |
| **Crop** | **2010** | **2020** | **2040** | **2060** | | | | | | | | | |
| Soybean | 1,506 | 1,454 | 1,350 | 1,246 | 10,900 | 22.490 | 22.490 | 22.490 | 22.490 | 22,970 | 21,800 | 19,461 | 17,122 |
| Wheat | 3,544 | 3,790 | 4,425 | 4,886 | 23,790 | 12.282 | 12.282 | 12.282 | 12.282 | 19,737 | 22,759 | 30,558 | 36,220 |
| Gram | 1027 | - | - | - | 12960 | 25.144 | 25.144 | 25.144 | 25.144 | 12863 | - | - | - |
| Mustard | 1,456 | 1,436 | 1,396 | 1,358 | 15,354 | 26.003 | 26.003 | 26.003 | 26.003 | 22,506 | 21,986 | 20,946 | 19,958 |
| Coriander | 1,114 | 1,247 | 1,377 | 1,459 | 19,000 | 36.083 | 36.083 | 36.083 | 36.083 | 21,196 | 25,996 | 30,686 | 33,645 |

## 5. Present Status of Existing Major/Medium Projects

The state has assets of 114 major and medium irrigation projects (considering Bhimlat-Abheypura as one and including canal projects having imported surface water) covering about 3.07 million hectare of irrigable land. The financial crunch in the last few decades has however resulted in ever deteriorating condition of most irrigation projects. Figure 5.1 shows the deteriorating conditions of some projects. Poor maintenance and water management have led to increasing water losses and reduction in irrigation system efficiencies as against their design norms. The major and medium existing projects are discussed below along with their present status. The gauge-capacity data (1996-2010) of these dams has been presented in Final Report No. 4.3.

Figure 5.1 Present Condition of Some Existing Projects

Khari Irrigation Project (Left Main Canal)

Khari Irrigation Project (Right Main Canal)

Sareri Irrigation Project (Left Main Canal)

Kothari Irrigation Project (Right Main Canal)

Kothari Irrigation Project (Left Main Canal)

Arwar Project (Right Main Canal)

Gopalpura Irrigation Project Canal affecting from pickup weir

Bilas Irrigation Project (Main Canal)

Bassi Irrigation Project (Main Canal)

Bassi Irrigation Project, Dubawa distributary Canal

Badgaon Irrigation Project (Main Canal)

Bhopal Sagar Irrigation Project (Canal No. 4)

Bhopal Sagar Irrigation Project (Canal no.5)

Bhopal Sagar Irrigation Project (Canal No. 3)

Bhopal Sagar Irrigation Project (Canal no.1)

Muraliya Irrigation Project (Left Main Canal)

## 5.1 Ajan Bund Project

### *5.1.1 Introduction*

Ajan Bund Project has been constructed as the terminal reservoir for Banganga water. The dam and reservoir are situated near Bharatpur City. The Banganga River which ends at Nekpur is diverted through Uchain Canal to feed small depressions enroute before ending in Ajan Bund. It was constructed in early part of the 19$^{th}$ Century by the then rulers of Bharatpur State. This reservoir also receives surplus water of Gambhir River through Pichuna Canal which carries water for inundation irrigation. After providing inundation irrigation to few enrooted tanks, it ends in Ajan Bund. Surplus water of Gambhir also ultimately gets diverted to this dam, through upper Ajan Bund, from Khanua.

The earthen embankment is 27 km long starting from village Daulatpur and ends near Sewar.

### *5.1.2 Important Features*

**(a) Catchment**

i. Free 217.56 km$^2$

**(b) Water Availability**

i. Design mean yield - NA

ii. Actual mean yield last 15 years 4.42 Mm$^3$

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | N.A. |
| ii. CCA | 8097 ha |

**(d) Storage Capacity**

| | |
|---|---|
| i. Gross | 17.97 Mm$^3$ |
| ii. Live | 17.97 Mm$^3$ |

**(e) Canals**

| | |
|---|---|
| i. Main Canal | Two |
| ii. Discharge at head | 14.94 cumecs & 10.87 cumecs |

iii. Length 2.280 km & 9.270 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 58.87% | 3921 |
| ii. | Barley | 2.20% | 3178 |
| iii. | Mustard | 35.33% | 1730 |
| iv. | Other | 3.60% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.1.3 Present Status*

The Ajan Bund has large area of 5424 ha under bed cultivation and most of the water is being utilized by Ghanna Keoladeo Bird Sanctuary. Therefore it is observed that the actual irrigation under canal has been very low as bund has to be emptied in time to enable bed cultivation. So it is not considered for rehabilitation.

## 5.2 Alnia Irrigation Project

### *5.2.1 Introduction*

Alnia Irrigation Project has been constructed on Chandrawati River near Alnia which is a tributary of Chambal River the dam and reservoir are situated near Alnia of Ladpura Tehhsil in Kota District the construction of dam and canal was completed in 1962.

### *5.2.2 Important Features*

**(a) Catchment**

i. Gross 201.43 $km^2$

ii. Free 183.00 $km^2$

**(b) Water Availability**

i. Design mean yield - 46.27 $Mm^3$

ii. Actual mean yield last 15 years 28.30 $Mm^3$

| (c) Command Area | | Designed | Actual |
|---|---|---|---|
| i. | GCA | 8986 ha | 8986 ha |
| ii. | CCA | 7882 ha | 7882 ha |
| iii. | Irrigated Area | 5636 ha | 4910 ha |

**(d) Storage Capacity**

i. Gross 43.71 $Mm^3$

ii. Live 43.71 $Mm^3$

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 3.973 cumecs & 0.263 cumecs |
| iii. | Length of two main canals | 17.07 km & 4.26 km |
| iv. | Branch/ Distributory/ Minor | 14 Nos. |
| v. | Length of Branch/ Distributory/ Minor | 59.04 km |

**(f) Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 68.40% | 3535 |
| ii. | Gram | 1.95% | 1070 |
| iii. | Barley | 0.11% | 3061 |
| iv. | Oil Seeds | 18.70% | 1240 |
| v. | Coriander | 5.60% | 1283 |
| vi. | Other | 5.24% | - |

**(g) Status of WUA** 11 Nos. WUA, 4 DC & 1PC

**(h) Status of micro-irrigation** Nil

### *5.2.3 Present Status*

The project has been rehabilitated under RWSRP in year 2012 and presently the overall efficiency is 51.77% which will further improve by active involvement of WUA in operational management and the main system improvement works have been carried out which are as under.

1. Redesign of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Construction with rectification outlets.
4. Lining of water courses.
5. Repair & Construction of VRB & measuring devices.
6. 11WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.3 Angore Irrigation Project

### *5.3.1 Introduction*

Angore Irrigation Project has been constructed on Krishanawati River which is a tributary of Luni River the dam and reservoir are situated near village Angore of Hindoli Tehsil in Sirohi District the construction of dam and canal was completed in 1988.

### *5.3.2 Important Features*

**(a) Catchment**

i. Gross 744.96 Sq. km

ii. Free 558.16 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A.

ii. Actual mean yield last 15 years 7.15 $Mm^3$

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 3350.79 ha |
| ii. CCA | 3455.28 ha |

**(d) Irrigated Area (Designed)**

| | |
|---|---|
| i. Rabi (Cropping intensity 28.5%) | 2630 ha |
| ii. Total | 2630 ha |

**(e) Storage Capacity**

| | |
|---|---|
| i. Gross | 14.02 $Mm^3$ |
| ii. Live | 13.22 $Mm^3$ |

**(f) Canals**

| | |
|---|---|
| i. Main Canal | Two |
| ii. Discharge at head | 4.09 cumecs & 7.32 cumecs |
| iii. Length | 26.21 km & 28.04 km |
| iv. Distributory/ Minor | 21 |
| v. Length | 102.55 km |

**(g) Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 15.2 % | 2449 |
| ii. | Mustard | 68.7% | 900 |
| iii. | Cumin | 13.1% | 287 |
| iv. | Caster | 3.0% | 35988 |

**(h) Status of WUA** 19 Nos. WUA, 3DC & 1PC exist

**(i) Status of micro-irrigation** Nil

### *5.3.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 54.27% which will further improve by active involvement of WUA in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

   As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.4 Arwar Irrigation Project

### *5.4.1 Introduction*

Arwar Irrigation Project has been constructed on Mansi River near Arwar which is a tributary of Khari River of Banas Basin. The dam and reservoir are situated near Arwar of Shahpura Tehsil in Bhilwara District the construction of dam and canal was completed in 1957.

### *5.4.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1145 $km^2$ |
| ii. | Free | 580 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 35.74 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 9.62 $Mm^3$ |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 13570 ha |
| ii. | CCA | 7394 ha |
| iii. | Irrigated Area | 5467 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 47.91 $Mm^3$ |
| ii. | Live | 47.80 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 4.59 cumecs & 1.30 cumecs |
| iii. | Length | 20.70 km & 6.3 km |
| iv. | Length of system | 64.80 km |

**(f) Cropping Pattern**

| | |
|---|---|
| Designed | NA |

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 48.79% | 2693 |
| ii. | Gram | 9.69% | 603 |
| iii. | Barley | 6.13% | 2192 |
| iv. | Oil Seeds | 22.56% | 1706 |
| v. | Cotton | 3.40% | 343 |
| vi. | Other | 9.69% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.4.3 Present Status*

The project has overall efficiency of 28%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take directly from the dam. Throughout the entire canal system, there exist no cross regulators across main canals, big size outlets are drawing more water. They also require repairs.
2. Banks of canals are deformed/eroded.
3. Channel sections in many reaches are deformed and requires resectioning.
4. Existing lined section are damaged and some of reaches are unlined.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.5 Badgaon Irrigation Project

### *5.5.1 Introduction*

Badgaon Irrigation Project has been constructed on Berach River near Badgaon which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Badgaon of Vallabh Nagar Tehsil in Udaipur District the construction of dam and canal was completed in 1966.

### *5.5.2 Important Features*

**(a) Catchment**

i. Gross 1699 $km^2$

ii. Free 398.22 $km^2$

**(b) Water Availability**

i. Design mean yield 50.77 $Mm^3$

ii. Actual mean yield last 15 years 4.19 $Mm^3$

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 7244 ha |
| ii. | CCA | 6797 ha |
| iii. | Irrigated Area | 3440 ha |
| **(d) Storage Capacity** | | |
| i. | Gross | 31.52 $Mm^3$ |
| ii. | Live | 30.19 $Mm^3$ |
| **(e) Canals** | | |
| i. | Main Canal | One |
| ii. | Discharge at head | 3.87 cumecs |
| iii. | Length | 28.3 km |
| iv. | Distributory/ Minor | 19 Nos. |
| v. | Length of system | 89.4 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 65.00% | 2340 |
| ii. | Gram & Other Pulses | 0.84% | 544 |
| iii. | Barley | 5.00% | 1807 |
| iv. | Oil Seeds | 25.24% | 939 |
| v. | Other | 3.92% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.5.3 Present Status*

The project has overall efficiency of 24.16%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of a main canal which off take directly from the dam. Throughout the entire canal system, there exist no cross regulators across main canal, big size outlets are drawing more water. They also require repairs.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed and requires resectioning.
4. Existing lined section are damaged and mostly reaches are unlined and requires resectioning.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.6 Bagolia Irrigation Project

### *5.6.1 Introduction*

Bagolia Irrigation Project has been constructed on Berach River near Badiya which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Badiya of Mavli Tehsil in Udaipur District the construction of dam and canal was completed in 1956.

### *5.6.2 Important Features*

**(a) Catchment**

i. Gross 1699 $km^2$

ii. Free 398.22 $km^2$

**(b) Water Availability**

i. Design mean yield - 12.5 $Mm^3$

ii. Actual mean yield last 15 years 3.26 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 3854 ha

ii. CCA 3676 ha

iii. Irrigated Area 1963 ha

**(d) Storage Capacity**

i. Gross 19.42 $Mm^3$

ii. Live 18.85 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Discharge at head 1.56 cumecs & 0.19cumecs

iii. Length 9.21 km & 3 km

iv. Distributory/ Minor 19 Nos.

v. Length of system 89.4 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 71.95% | 2340 |
| ii. | Gram | 1.81% | 1060 |
| iii. | Barley | 8.86% | 1807 |
| iv. | Oil Seeds | 15.48% | 693 |
| v. | Other | 1.90% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.6.3 Present Status*

The project has overall efficiency of 11.6%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. Banks of canals are deformed /eroded.
2. Channel sections in many reaches are deformed and require resectioning.
3. Existing lined section are damaged and mostly reaches are unlined and requires resectioning.
4. Numbers of siphons/VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.7 Bandi Sendhara Irrigation Project

### *5.7.1 Introduction*

Bandi Sendhara Irrigation Project has been constructed on Bandi River which is a tributary of Sukri River of Luni Basin .The dam and reservoir are situated near village Sendhara of Bhinmal Tehsil in Jalore District the construction of dam and canal was completed in 2007.

### *5.7.2 Important Features*

**(a) Catchment**

i. Gross 430.00 $km^2$

ii. Free 382.00 $km^2$

**(b) Water Availability**

i. Design mean yield - NA

ii. Actual mean yield last 15 years 7.8 $Mm^3$ (Average of year 2007 to 2010)

**(c) Command Area** **Designed**

i. GCA 6618 ha

ii. CCA 6238 ha

iii. ICA 4615 ha

**(d) Irrigated Area**

i. Kharif 923 ha

ii. Rabi 4153 ha

**(e) Storage Capacity**

i. Gross 28.67 $Mm^3$

ii. Live 25.8 $Mm^3$

**(f) Canals**

i. Main Canal One

ii. Discharge at head 2.00 cumecs

iii. Length 17.7 km

iv. Distributory/ Minor 6 Nos.

v. Length 24.65 km

**(g) Cropping Pattern & Productivity**

**Designed Cropping Pattern**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| | **Kharif** | | |
| i. | Bajra | 75% | 50 |
| ii. | Guar | 15% | 298 |
| iii. | Pulses | 10% | 421 |
| | **Rabi** | | |
| i. | Wheat | 17% | 1989 |
| ii. | Gram | 7% | 798 |
| iii. | Barley | 2% | 2432 |
| iv. | Mustard | 56% | 1292 |
| v. | Cumin/Sagol | 16% | 535 |
| vi. | Rabi Fodder | 2% | 453 |

**(h) Status of WUA** Not formed

**(i) Status of micro-irrigation** Nil

### *5.7.3 Present Status*

The project has been constructed recently and overall efficiency is 57% therefore. There is no need to rehabilitate the project.

## 5.8 Bankli Bund Irrigation Project

### *5.8.1 Introduction*

Bankli Bund Irrigation Project has been constructed on Sukari River which is a tributary of Luni River. The dam and reservoir are situated near Bhadrajun in Rohat Tehsil in Pali District the construction of dam and canal was completed in 1904.

### *5.8.2 Important Features*

**(a) Catchment**

i. Gross 1777 $km^2$

ii. Free 1431 $km^2$

**(b) Water Availability**

i. Design mean yield - NA

ii. Actual mean yield last 15 years 7.66 $Mm^3$

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 5772 ha | 5772 ha |
| ii. CCA | 5380 ha | 5380 ha |
| iii. ICA | 3767 ha | 3767 ha |
| iv. Intensity of Irrigation | 70% | |
| v. Irrigated Area | 3767 ha | 2471 ha |

**(d) Storage Capacity**

i. Gross 34.53 $Mm^3$

ii. Live 34.51 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Discharge at head 3.06 cumecs & 0.47 cumecs

iii. Length 6.77 km & 5.49 km

iv. Distributory/ Minor 6 Nos.

v. Length 25.66 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 25.8% | 1980 |
| ii. | Gram | 14.8% | 1080 |
| iii. | Cumin | 5.6% | 266 |
| iv. | Mustard | 53.8% | 932 |

**(g) Status of WUA** 5 Nos. WUA & 1 DC

**(h) Status of micro-irrigation** Nil

### *5.8.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 41% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.

2. New lining in Vulnerable Reaches & lining of Water Course d/s of outlet in 15 m Length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 5WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.9 Bund Baretha Irrigation Project

### *5.9.1 Introduction*

Bund Baretha Irrigation Project has been constructed on Kukund River which is a tributary of Gambhir River. The dam and reservoir are situated near Baretha of Bayana Tehsil in Bharatpur District. The construction of dam and canal was completed in 1897.

### *5.9.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 182 $km^2$ |
| ii. | Free | 182 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 18.82$Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 4388.25 ha | 4388 ha |
| ii. | CCA | 4243.00 ha | 4243 ha |
| iii. | ICA | 2970 ha | 2970 ha |
| iv. | Intensity of Irrigation | 70% | |
| v. | Irrigated Area | 2970 ha | 1368.35 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 52.6321 $Mm^3$ |
| ii. | Live | 50.650 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Three |
| ii. | Discharge at head | 1.467 cumecs , 1.105 cumecs 1.735cumecs |
| iii. | Length | 23.925 km |
| iv. | Distributory/ Minor | 16 Nos. |
| v. | Length | 110 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 74.00% | 3921 |
| ii. | Barley | 0.30% | 3178 |
| iii. | Gram | 3.34% | 1197 |
| iv. | Mustard | 16.00% | 1730 |
| v. | Other (Vegetables, Rijika & Pulses etc.) | 6.36% | - |

**(g) Status of WUA** 7 Nos. WUA , 2DC & 1PC

**(h) Status of micro-irrigation** Nil

### *5.9.3 Present Status*

The project has been rehabilitated under RWSRP in 2009 and presently the overall efficiency is 42% and this will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 7WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.10 Bassi Irrigation Project

### *5.10.1 Introduction*

Bassi Irrigation Project has been constructed on Local Drain near Bassi which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Bassi of Chittaurgarh Tehsil in Chittaurgarh District the construction of dam and canal was completed in 1986.

### *5.10.2 Important Features*

**(a) Catchment**

i. Gross 453 $km^2$

ii. Free 122 $km^2$

**(b) Water Availability**

i. Design mean yield - 21.96 $Mm^3$

ii. Actual mean yield last 15 years 17.56 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 5899 ha

ii. CCA 3250 ha

iii. Irrigated Area 3169 ha (54% in Rabi & 43.5% in Kharif)

**(d) Storage Capacity**

i. Gross 23.2 $Mm^3$

ii. Live 20.25 $Mm^3$

**(e) Canals**

i. Main Canal One

ii. Discharge at head 2.70 cumecs

iii. Length 15.6 km

iv. Distributory/ Minor 9 Nos.

v. Length of system 30.79 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 61.40% | 3295 |
| ii. | Barley | 3.51% | 2886 |
| iii. | Gram | 0.95% | 946 |
| iv. | Mustard | 27.43% | 1223 |
| v. | Other Rabi Pulses | 0.70% | 800 |
| vi. | Others | 5.77% | - |
| | **Total** | **100%** | |
| | **Kharif** | | |
| i. | Maize | 45.92% | 1747 |
| ii. | Oil Seeds | 21.44% | 1108 |
| iii. | Sugarcane | 15.00% | 54665 |
| iv. | Kharif Other | 13.56% | - |
| | **Total** | **100%** | |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.10.3 Present Status*

The project has overall efficiency of 15.89%. It is seen that actual overall efficiency is much below than designed due to following reasons

1. The project canal system comprises of one main canal which off take from the dam. Existing lined section are damaged and mostly reaches are unlined and require resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.
4. WUAs are not formed.
5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.11 Bethali Irrigation Project

### *5.11.1 Introduction*

Bethali Irrigation Project has been constructed on Bethali River which is a tributary of Parwati of Chambal Basin. The dam and reservoir are situated near village Niyamatpura of Chhabra Tehsil in Baran District the construction of dam and canal was completed in 2001.

### *5.11.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 143.34 $km^2$ (96.24 $km^2$ in Rajasthan & 47.11 $km^2$ in M.P) |
| ii. | Free | 101 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 37.3 $Mm^3$ |
| ii. | Actual mean yield last 9 years | 19.70 $Mm^3$ |

**(c) Water Utilization**

| | | |
|---|---|---|
| i. | Irrigation | 29 $Mm^3$ |
| ii. | Thermal power project | 5.66 $Mm^3$ |

| | | |
|---|---|---|
| **(d) Command Area** | | **Designed** |
| i. | GCA | 5526 ha |
| ii. | CCA | 5026 ha |
| iii. | Irrigated Area | 5026 ha (Intensity in Rabi 69% & 31% in Kharif) |

**(e) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 37.28 $Mm^3$ |
| ii. | Live | 34.67 $Mm^3$ |

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal at head | Two |

| | | |
|---|---|---|
| ii. | Length | 14.05 km.&16.08 |
| iii. | Distributory/ Minor | N.A |
| iv. | Length | N.A |

**(g) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Kharif** | | |
| i. | Rice | 89.20 | 2228 |
| ii. | Soyabeans | 8.50% | 1140 |
| iii. | Citrus | 0. 8% | 281 |
| iv. | Ground Nuts | 0.2% | 1667 |
| v. | Red Chilli | 1.3% | 1129 |
| | **Kharif Total** | **100%** | |
| | **Rabi** | | |
| i. | Wheat | 35.82% | 3761 |
| ii. | Barley | 0.02% | 2477 |
| iii. | Gram | 1.18% | 1029 |
| iv. | Coriander | 26.18% | 1159 |
| v. | Mustard | 36.68% | 1415 |
| vi. | Others | 0.12% | - |

**(h) Status of WUA** Not formed

**(i) Status of micro-irrigation** Nil

### *5.11.3 Present Status*

The project has been constructed recently and overall efficiency is 52.5% therefore there is no need to rehabilitate the project.

## 5.12 Bhakra Canal Project

### *5.12.1 Introduction*

When Bhakra Project was first conceived, efforts were made by the then rulers of Bikaner State to include areas of Rajasthan under the command of Bhakra Canal. The matter started being pursued more vigorously by the Maharaja of Bikaner from the early nineteen-thirties, when Gang Canal work was completed and the project started giving benefits and brought economic and socio-economic changes to the State. He was aware that areas near Hanumangarh could easily be commanded by a canal from Ropar. When Bhakra Canal network was developed to include areas supplied by the already existing Sirhind and Ghaggar canals, it was evident that adjoining areas of Bikaner State could also be commanded by Bhakra Canal. It was however only in

1948 that a final decision was made about the extent of Rajasthan areas to be included in the command of branches and distributaries of Bhakra system which were covering adjoining areas of the then Province of Punjab. 372,300 ha (920,000 acres) of Rajasthan area were included in the CCA of Bhakra Canal, starting from Nangal Head Works, upstream of Ropar. The planned intensity of irrigation was 26% in the Kharif season and 36% in the Rabi season Considering all the existing and new areas, the total CCA under Bhakra Canal system amounts to 3,880,827 ha (9,585,644 acres), out of which the CCA in Rajasthan is 372,300 ha, This area in Rajasthan is under the command of different branches and distributaries of Bhakra Main Line, which has an extensive distribution system in Punjab and Haryana.

Rajasthan receives its share of supplies at the following five points:

| | Contact Point | CCA ×100,000 acres | CCA ×1,000 ha | Discharge cusecs | Discharge $m^3$/sec | Branch System |
|---|---|---|---|---|---|---|
| 1. | Tail of Sirhind Feeder | 5.87 | 237.5 | 1610 | 45.59 | Sadul and Karnisigh |
| 2. | Tail of Jandwala Dsty. | 0.79 | 32.0 | 255 | 7.22 | Khara Sub-branch |
| 3. | Tail of South Ghaggar | 0.98 | 39.7 | 266 | 7.53 | Ghaggar Sub-branch |
| 4. | Tail of Baruwali Dsty. | 0.39 | 15.8 | 106 | 3.00 | Jasana System |
| 5. | Tail of Kishangarh Br. | 1.17 | 47.3 | 355 | 10.05 | Amarsigh Sub-Br. |
| | **Total** | **9.20** | **372.3** | **2592** | **73.39** | |

The distribution and delivery of water to Rajasthan area is governed by the Bhakra Nangal Agreement between the erstwhile State of Punjab (now Punjab and Haryana) and the State of Rajasthan, signed in 1959. Under this agreement Rajasthan is a partner in Bhakra Nangal Project and is entitled to receive 15.22% of both stored water supply and power generated. However, Rajasthan's actual share of water in the filling and emptying period of Bhakra Dam is about 11% only, because an allowance had to be made to pre-Bhakra supplies to the already existing irrigation systems under command of Sirhind and Bisht Doab Canals, which had a preferential right over Sutlej water and had to be assured uninterrupted supplies. Under Bhakra Nangal Agreement the total allocation of water to Rajasthan was 1,837 $Mm^3$ (1.49 MAF). Rajasthan could however be allocated additional 259 $Mm^3$ (0.21 MAF) for this system out of its share of 10,608 $Mm^3$ (8.6 MAF) in the surplus Ravi and Beas waters. Thus the total annual allocation for Rajasthan in this system is 2,096 $Mm^3$ (1.70 MAF), out of the total allocation of 13,830 $Mm^3$/yr to Rajasthan from the Ravi - Beas - Sutlej system of rivers. Out of allocated 2,096 $Mm^3$, 64 $Mm^3$ is reserved for non-agricultural uses and remaining 2,032 64 $Mm^3$ is allocated to irrigation. The actual water received by Rajasthan is shown in Annex 5.

**Transfer of Areas to Sirhind Feeder**

After the allocation of water supplies from Rivers Ravi, Beas and Sutlej became broadly known, the Government of Punjab prepared a proposal to construct the Sirhind Feeder Canal, branching off Harike Barrage, and Firozpur Feeder, from Firozpur Headworks, to ensure steady supplies to those areas of the already existing Sirhind Canal which were to be cut off by the proposed Rajasthan Feeder. These areas were otherwise receiving their supplies from Sirhind Canal starting at Ropar Headworks. All the areas, including some under Bhakra Canal in Rajasthan, are so situated that they can also be easily commanded by canals from Harike Barrage.

To take advantage of additional supplies which would be available at Harike, Sirhind Feeder project was proposed, with the objective of using the saved Sutlej water to supplement irrigation in the higher areas of Sirhind and Bhakra Canal commands. Some areas of Rajasthan, particularly those under command of Sadul and Karniji branches of Bhakra command, were also transferred to Sirhind Feeder, and the water so saved was decided to be used in Punjab areas. This arrangement did not affect Rajasthan's share in Bhakra system as it was only an exchange arrangement without affecting the cost of and benefits from Bhakra project.

Under the above arrangement about two thirds of Rajasthan area at the tail end of Bhakra command started receiving Ravi and Beas water from Harike, with a comparatively more reliable availability. Moreover, Rajasthan Feeder, which runs parallel to Sirhind Feeder, provides the flexibility of supplementing and adjusting the supplies at the tail end of Sirhind Feeder in situations of urgency and emergency.

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Kharif** | | |
| i. | Cotton | 8.18% | 1219 |
| ii. | Pulses | 4.76% | 515 |
| iii. | Bajra | 4.57% | 1631 |
| iv. | Ground Nuts | 7.53% | 1935 |
| v. | Paddy | 0.20% | 5119 |
| vi. | Gawar | 70.51% | 829 |
| vii. | Fodder | 4.25% | NA |
| viii. | Other | 0.50% | - |
| | **Rabi** | | |
| i. | Wheat | 23.14% | 3537 |
| ii. | Gram | 46.21% | 575 |
| iii. | Mustard | 21.47% | 1588 |
| iv. | Barley | 2.16% | 3078 |
| v. | Fodder | 3.69% | NA |
| vi. | Others | 3.33% | - |

### *5.12.2 Present Status*

The Rajasthan branches of Bhakra Canal system, and some of the sub-branches, are lined, while the rest of the system is unlined. The length of existing lined branches and sub-branches in this system in Rajasthan is 120 km. The length of unlined sub-branches, distributaries and Minors is 1,228 km. The total number of Chaks (clusters of plots) is 1,293. The water courses in these Chaks, totaling some 11,000 km, are also unlined.

A system of rotational water supply called Warabandi is being practiced in the Bhakra Canal command area. The canal outlets are of the APM type, and are adequately

controlled. In some of the Chaks the cultivators have constituted Farmers' Irrigation Panchayats, and they manage the distribution of water among themselves with the services of a time keeper (Mirab). This practice is however gradually disappearing, and more people are adopting Warabandi with water distribution rosters controlled by ID officers. Where the existing lining has deteriorated and requires urgent attention. This is necessary to save the existing system, even if modernization of the canal system is not done. Therefore the modernization has been started by the Irrigation Department, Under RWSRP Programme all the canals are to be lined, and canal losses are expected to be substantially.

The project is being rehabilitated under RWSRP and presently the overall efficiency is 52.66% this will further improve by active involvement of WUAs in operational management. The main system improvement works are being carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in unlined and vulnerable reaches and lining of water courses.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair and Construction of VRB.
5. WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is being rehabilitated under RWSRP & AIBP, therefore there is no need for further rehabilitation.

## 5.13 Bharatpur Feeder Project

### *5.13.1 Introduction*

Bharatpur Feeder branches from the Aring Distributary of Agra Canal, with a full supply capacity of 8.5 $m^3$/sec. Rajasthan receives this water for a limited period, only when the total available supplies exceed the requirements of UP. The area under command of Bharatpur Feeder is 10,729 ha. The feeder length inside UP is 13.41 km, and in Rajasthan. The salient features are given below.

### *5.13.2 Important Features*

**(a) Command Area**

Total Culturable Command Area 10729 ha

**(b) Intensity of Irrigation**

**(c) Main Canal**

i. Discharge at head 8.5 cumecs

ii. Length 13.41km

**(d) Status of WUA** Not formed

**(e) Status of micro-irrigation** Nil

**(f) Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 31.0% | 3921 |
| ii. | Gram | 4.5% | 1197 |
| iii. | Barley | 30.0% | 3178 |
| iv. | Mustard | 32.0% | 1730 |
| v. | Maithi | 1.0% | 1167 |
| vi. | Other | 1.5% | - |

### *5.13.3 Present Status*

At present Bharatpur Feeder supplies water to Rajasthan only when water availability exceeds the requirements of UP. Under the terms of the interstate agreement supplies to Rajasthan are expected to be released regularly. To achieve this, and to utilize Rajasthan's entire share, the existing feeder would not need any modifications except extension of some 5 km of minor and distributary canals from the tail end of the Feeder, to cover a total CCA of 24,600 ha. Rajasthan would continue to draw 8.5 $m^3$/sec from Aring Distributary of Agra Canal through Bharatpur Feeder. No modifications in this system are proposed to be carried out.

## 5.14 Bhim Sagar Irrigation Project

### *5.14.1 Introduction*

Bhim Sagar Irrigation Project has been constructed on Ujjar River which is a tributary of Kalisindh River of Chambal Basin. The dam and reservoir are situated near village Man-Borda of Khanpur Tehsil in Jhalawar District the construction of dam and canal was completed in 1996.

### *5.14.2 Important Features*

**(a) Catchment**

i. Gross 335 $km^2$

ii. Free 328.30 $km^2$

**(b) Water Availability**

i. Design mean yield - 135.4 $Mm^3$

ii. Actual mean yield last 15 years 51.00 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 10512 ha

ii. CCA 9986 ha

**(d) Irrigated Area**

i. Kharif 2246 ha

ii. Rabi 7240 ha

**(e) Storage Capacity**

i. Gross 76.6 $Mm^3$

ii. Live 72.53 $Mm^3$

**(f) Canals**

i. Main Canal Two

ii. Discharge at head 5.24 cumecs & 1.95 cumecs

iii. Length 29.26 km & 16.36 km

iv. Distributory/ Minor N.A

v. Length N.A

**(g) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| | **Kharif** | | |
| i. | Rice | 89% | 1999 |
| ii. | Kharif Pulses | 10% | 222 |
| iii. | Others | 1% | 22 |
| | **Rabi** | | |
| i. | Wheat | 28% | 3337 |
| ii. | Gram | 2% | 907 |
| iii. | Barley | 1% | 3061 |
| iv. | Mustard | 29% | 1377 |
| v. | Coriander | 37% | 1098 |
| vi. | Other | 3% | - |

**(h) Status of WUA** 14 Nos. WUA, 3DC & 1PC

**(i) Status of micro-irrigation** Nil

### *5.14.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 28.91% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches & lining of Water Course d/s of outlet in 15 m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.

5. 14WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.15 Bhimlat-Abaypura Irrigation Project

### *5.15.1 Introduction*

Bhimlat-Abaypura Project consists of two storage dams constructed on Mangali River which is a tributary of Chambal River. The upper dam, Bhimlat is situated 35 km from Bundi and completed in 1957. The Lower dam, Abaypura was constructed in 1983 and situated near Megharawat ka Jhoparia 26 km from Bundi.

### *5.15.2 Important Features*

| | | | |
|---|---|---|---|
| **(a)** | **Catchment** | **Bhimlat** | **Abaypura** |
| | i. Gross | 101 $km^2$ | 126.9 $km^2$ |
| | ii. Free | 558.16 $km^2$ | |
| **(b)** | **Water Availability** | | |
| | i. Design mean yield - | 14.66 $Mm^3$ | 18.57 $Mm^3$ |
| | ii. Actual mean yield last 15 years | 10.43 $Mm^3$ | 6.90 $Mm^3$ |
| **(c)** | **Command Area** | **Designed** | |
| | i. GCA | 3632 ha | |
| | ii. CCA | 3402 ha | |
| **(d)** | **Irrigated Area(Designed)** | | |
| | i. Rabi (Cropping intensity 76.00%) | 2586 ha | |
| | ii. Total | 2586 ha | |
| **(e)** | **Storage Capacity** | **Bhimlat** | **Abaypura** |
| | i. Gross | 11.66 $Mm^3$ | 7.4 $Mm^3$ |
| | ii. Live | 11.60 $Mm^3$ | 7.27 $Mm^3$ |
| **(f)** | **Canals** | | |
| | i. Main Canal | Two | |
| | ii. Discharge at head | 0.533 cumecs & 2.788 cumecs | |
| | iii. Length | 2.60 km & 9.20 km | |
| | iv. Distributory/ Minor | 9 | |
| | v. Length | 26.29 km | |

**(g) Present Cropping Pattern & Productivity**

| | **Crops Rabi** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 91.64 % | 3394 |

| | | | |
|---|---|---|---|
| ii. | Gram | 1.26% | 739 |
| iii. | Mustard | 2.88% | 1109 |
| iv. | Pulses | 0.45% | 1496 |
| v. | Vegetables, Rijka & Others | 3.77% | - |

**(h) Status of WUA** 6 Nos.WUA, 2DC & 1PC exist

**(i) Status of micro-irrigation** Nil

### *5.15.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 47% which will further improve by active involvement of WUAs in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.16 Bhupal Sagar Irrigation Project

### *5.16.1 Introduction*

Bupal Sagar Irrigation Project has been constructed on Local Drain near Bupal Sagar which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Bassi of Kapasan Tehsil in Chittaurgarh District the construction of dam and canal was completed in 1936.

### *5.16.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 215 $km^2$ |
| ii. | Free | 176.4 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 12.05 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 4.62 $Mm^3$ |

| | | |
|---|---|---|
| **(c)** | **Command Area** | **Designed** |
| i. | GCA | 4401 ha |
| ii. | CCA | 3873 ha |
| iii. | Irrigated Area | 2104 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 18.54 $Mm^3$ |
| ii. | Live | 18.42 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Five |
| ii. | Discharge at head | 0.21 cumecs, 0.702 cumecs, 0.717 cumecs, 1008 cumecs, 0.038 cumecs |
| iii. | Total length | 37.15 km (3.75 km, 9.0 km, 8.5 km, 13.5 km, 2.40 km) |
| iv. | Distributory/ Minor | 7 Nos. |
| v. | Length of system | 14.7 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 36.0% | 3295 |
| ii. | Barley | 3.0% | 2886 |
| iii. | Gram | 0.9% | 946 |
| iv. | Mustard | 55.1% | 1223 |
| v. | Others | 5.0% | - |
| | **Total** | **100%** | |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.16.3 Present Status*

The project has overall efficiency of 37.51%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of five canals which off take directly from the dam. Existing lined section are damaged and mostly reaches are unlined and requires resectioning & lining.
2. No of outlets are over capacity.
3. Banks of canals are deformed /eroded.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.17 Bilas Irrigation Project

### *5.17.1 Introduction*

Bilas Irrigation Project has been constructed on Bilas River near Bundi which is a tributary of Parvati River of Chambal Basin the dam and reservoir are situated near Bhagwangarh of Kishanganj Tehsil in Baran District the construction of dam and canal was completed in 1995.

### *5.17.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 223 $km^2$ |
| ii. | Free | 146.5 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 24.77 $Mm^3$ |

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 6390 ha |
| ii. | CCA | 5863.00 ha |
| iii. | Irrigated Area | 5863 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 28.88 $Mm^3$ |
| ii. | Live | 26.76 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.916 cumecs |
| iii. | Length | 20.7 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 46.78% | 3761 |
| ii. | Gram | 8.44% | 1029 |
| iii. | Barley | 0.28% | 3060 |
| iv. | Oil Seeds | 13.60% | 1441 |
| v. | Sugarcane | 19.36% | 57447 |
| vi. | Other | 11.54% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.17.3 Present Status*

The project has overall efficiency of 33.41%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one main canal which off take from the dam.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed and require resectioning.
4. Existing lined section are damaged and some of reaches are unlined.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.18 Bisalpur Project

### *5.18.1 Introduction*

Bisalpur Project has been constructed on Banas River near village Bisalpur the dam and reservoir are situated in Todaraisingh Tehsil in Tonk District. Work on the dam & canal was started in 1987 and completed in 1999.

### *5.18.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 27726.km |
| ii. | Free | 8655 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 1316.4 $Mm^3$ |
| ii. | Actual mean yield last 12 years | 438.87 $Mm^3$ |

**(c) Reservation of water (excluding evaporation losses)**

| | | |
|---|---|---|
| i. | Drinking water | 458.46 $Mm^3$ |
| ii. | Irrigation water | 226.40 $Mm^3$ |

| **(d) Command Area** | **Designed** |
|---|---|
| i. GCA | 113723 ha |
| ii. CCA | 81800 ha |

**(e) Irrigated Area**

| | | |
|---|---|---|
| i. | Kharif | 22904 ha |
| ii. | Rabi | 35992 ha |

**(f) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 1095.84 $Mm^3$ |
| ii. | Live | 893.91 $Mm^3$ |

**(g) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 20.81 cumecs & 3.10 cumecs |
| iii. | Length | 51.64 km & 18.65 km |
| iv. | Distributaries/ Minor | Nos. |
| v. | Length | 600 km |

**(h) Cropping Pattern**

**Designed Cropping Pattern**

| S. No. | Crop | Total area (ha) Irrigated | Cropping Pattern % of CCA | Productivity (Kg/ha) |
|---|---|---|---|---|
| **Kharif** | | | | |
| i. | Jawar | 9816 | 12% | 454 |
| ii. | Groundnuts | 3272 | 4% | 558 |
| iii. | Maize | 6544 | 8% | 258 |
| iv. | Soybean | 3272 | 4% | 1165 |
| **Total Kharif** | | **22904** | **28%** | |
| **Rabi** | | | | |
| i. | Wheat | 15542 | 19% | 2673 |
| ii. | Barley | 1636 | 2% | 1978 |
| iii. | Gram | 5726 | 7% | 502 |
| iv. | Coriander | 2454 | 3% | 1125 |
| v. | Mustard | 10634 | 13% | 769 |
| **Total Rabi** | | **35992** | **44%** | |
| **Total** | | **58896** | **72%** | |

**Present Cropping Pattern & Productivity** NA

**(i) Status of micro-irrigation** Nil

### *5.18.3 Present Status*

The project has been Constructed recently and overall efficiency is 48.75% therefore there is no need to rehabilitate the project.

## 5.19 Bisalpura Irrigation Project

### *5.19.1 Introduction*

Bisalpura Irrigation Project has been constructed on Michri or Jojri River which is a tributary of Luni River. The dam and reservoir are situated near Bisalpur village of Mandore Tehsil in Jodhpur District the construction of dam and canal was completed in 1991.

### *5.19.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 914 $km^2$ |
| ii. | Free | 494 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 9.33 |

ii. Actual mean yield last 15 years Negligible inflow in dam for the last 15 years

| | | Designed | Actual |
|---|---|---|---|
| **(c) Command Area** | | | |
| i. | GCA | 1244.94 ha | 1244.94 ha |
| ii. | CCA | 1145 ha | 1145 ha |
| iii. | ICA | 831 ha | 831 ha |
| iv. | Irrigated Area | 831 ha | 831 ha |
| **(d) Storage Capacity** | | | |
| i. | Gross | 6.6 $Mm^3$ | |
| ii. | Live | 5.82 $Mm^3$ | |
| **(e) Canals** | | | |
| i. | Main Canal | Four | |
| ii. | Discharge at head | 3.06 cumecs | |
| iii. | Length | 15.31 km | |
| iv. | Distributory/ Minor | 6 Nos. | |
| v. | Length | 21.66 km | |
| **(f) Cropping Pattern** | | | |
| | Designed | NA | |

**Present Cropping Pattern & Productivity** There is no irrigation for the last 15 years

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.19.3 Present Status*

There is negligible inflow in dam for the last 15 years therefore this Project has not been considered for rehabilitation.

## 5.20 Buchara Irrigation Project

### *5.20.1 Introduction*

Buchara Irrigation Project has been constructed on Local Nallah near Buchara village which is a tributary of Sabi River the dam and reservoir are situated near village Buchara of Kotputli Tehsil in Jaipur District the construction of dam and canal was completed in 1889.

### *5.20.2 Important Features*

**(a) Catchment**

i. Gross 309.76 $km^2$

ii. Free 309.76 $km^2$

**(b) Water Availability**

i. Design mean yield - NA

ii. Actual mean yield last 15 years 6.48 $Mm^3$

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 3247 ha | 3249 ha |
| ii. CCA | 2638 ha | 2023 ha |
| iii. Irrigated Area | 1642 ha | 1298 ha |

**(d) Storage Capacity**

| | |
|---|---|
| i. Gross | 16.36 $Mm^3$ |
| ii. Live | 16.36 $Mm^3$ |

**(e) Canals**

| | |
|---|---|
| Main Canal | One |
| i. Discharge at head | 3.076 cumecs |
| ii. Length | 7.0 km |
| iii. Distributory/ Minor | 4 Nos. |
| iv. Length | 29 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 31.0% | 3214 |
| ii. | Gram | 4.5% | 912 |
| iii. | Barley | 30.0% | 3041 |
| iv. | Mustard | 32.0% | 1028 |
| v. | Maithi | 1.0% | 1011 |
| vi. | Other | 1.5% | - |

**(g) Status of WUA** 4 Nos. WUA exist 100%

**(h) Status of micro-irrigation** Nil

### *5.20.3 Present Status*

The project has been rehabilitated under RWSRP and the main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Pipe out let have been replaced to gate.
4. Repair & Construction of VRB.

5. 4 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.21 Bundi Ka Gothra Irrigation Project

### *5.21.1 Introduction*

Bundi Ka Gothra Irrigation Project has been constructed on Local Nallah Bajiyan which joined Mej River which is a tributary of Chambal River the dam and reservoir are situated near village Bundi Ka Gothra of Hindoli Tehsil in Bundi District the construction of dam and canal was completed in 1957.

### *5.21.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 319.20 $km^2$ |
| ii. | Free | 319.20 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 19.70 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 10.30 $Mm^3$ |

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 8112 ha |
| ii. CCA | 5560 ha |

| **(d) Irrigated Area** | **Designed** | **Actual** |
|---|---|---|
| i. Rabi | 2783 ha | 1715.87 |
| **Total** | **2783 ha** | **1715.87** |

**(e) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 18.97 $Mm^3$ |
| ii. | Live | 18.97 $Mm^3$ |

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.21 cumecs |
| iii. | Length | 28.04 km |
| iv. | Branch/Distributory/ Minor | 20 |
| v. | Length | 37.29 km |

**(g) Cropping Pattern & Productivity**

**Present Cropping Pattern** (At present project canals are operated for Rabi only.)

| Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|
| **Rabi** | | |
| i. Wheat | 83.85% | 3394 |
| ii. Barley | 1.16% | 3061 |
| iii. Gram | 0.70% | 739 |
| iv. Pulses | 1.63% | 694 |
| v. Mustard (Oil Seeds) | 5.58% | 1109 |
| vi. Vegetables, Spices, Rijka & Others | 7.07% | - |
| **Total** | **100%** | |

**(h) Status of WUA** 7 Nos. WUA , 2 DC & 1 PC exist

**(i) Status of micro-irrigation** Nil

### *5.21.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 50.15% which will further improve by active involvement of WUA in operational management and the dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. 19 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.22 Burdha Irrigation Project

### *5.22.1 Introduction*

Burdha Irrigation Project has been constructed on Talera River near Bundi which is a tributary of Chambal River the dam and reservoir are situated near Bundi of Bundi Tehsil in Bundi District the construction of dam and canal was completed in 1904.

### *5.22.2 Important Features*

**(a) Catchment**

i. Gross 334.13 $km^2$

ii. Free 261.60 $km^2$

**(b) Water Availability**

i. Design mean yield - NA

ii. Actual mean yield last 15 years 28.59 $Mm^3$

| | | | |
|---|---|---|---|
| **(c)** | **Command Area** | **Designed** | **Actual** |
| | i. GCA | 4611.7 ha | 4611.7 ha |
| | ii. CCA | 4251.0 ha | 4251.0 ha |
| | iii. Irrigated Area | 4251.0 ha | 4251.0 ha |
| **(d)** | **Storage Capacity** | | |
| | i. Gross | 29.97 $Mm^3$ | |
| | ii. Live | 28.83 $Mm^3$ | |
| **(e)** | **Canals** | | |
| | i. Main Canal | Two | |
| | ii. Discharge at head | 2.97 cumecs & .157 cumecs | |
| | iii. Length | 20.7 km & 4.95 km | |
| | iv. Distributory/ Minor | 6 Nos. | |
| | v. Length | 27.9 km | |
| **(f)** | **Cropping Pattern** | | |
| | Designed | NA | |

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 46.78% | 3394 |
| ii. | Gram | 8.44% | 739 |
| iii. | Barley | 0.28% | 3061 |
| iv. | Oil Seeds | 13.60% | 1109 |
| v. | Sugarcane | 19.36% | 40284 |
| vi. | Other | 11.54% | - |

**(g) Status of WUA** 7 Nos. WUA , 2DC & 1PC exist

**(h) Status of micro-irrigation** Nil

### *5.22.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 48% which will further improve by active involvement of WUAs in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Pipe out let have been replaced to gate.

4. Repair & Construction of VRB.
5. WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.23 Chandrabhaga Irrigation Project

### *5.23.1 Introduction*

Chandrabhaga Irrigation Project has been constructed on Chandrabhaga near Phunkia which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Phunkia of Railmagra Tehsil in Rajsamand District the construction of dam and canal was completed in 1957.

### *5.23.2 Important Features*

**(a) Catchment**

i. Gross 384 $km^2$

ii. Free 132 $km^2$

**(b) Water Availability**

i. Design mean yield - 12.74 $Mm^3$

ii. Actual mean yield last 15 years N.A

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 6880 ha |
| ii. CCA | 3342 ha |
| iii. Irrigated Area | 1128 ha |

**(d) Storage Capacity**

| | |
|---|---|
| i. Gross | 9.97 $Mm^3$ |
| ii. Live | 9.85 $Mm^3$ |

**(e) Canals**

| | |
|---|---|
| i. Main Canal | Two |
| ii. Discharge at head | 1.30 cumecs & 0.48 cumecs |
| iii. Length | 10.5 km & 1.50 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 61.40% | 2602 |
| ii. | Barley | 3.51% | 1985 |

| | | | |
|---|---|---|---|
| iii. | Gram | 0.95% | 780 |
| iv. | Mustard | 27.43% | 719 |
| v. | Other Rabi Pulses | 0.70% | 1136 |
| vi. | Others | 5.77% | - |
| | **Total** | **100%** | |
| **Kharif** | | | |
| i. | Maize | 45.92% | 993 |
| ii. | Oil Seeds | 21.44% | 684 |
| iii. | Sugarcane | 15.00% | 45227 |
| iv. | Kharif Other | 13.56% | - |
| | **Total** | **100%** | |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.23.3 Present Status*

The project has overall efficiency of 9%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two canals which off take from the dam. Existing lined sections are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.
4. WUAs are not formed.
5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.24 Chandsen Irrigation Project

### *5.24.1 Introduction*

Chandsen Irrigation Project has been constructed on Local Drain which joins Mashi a tributary of Banas River, the dam and reservoir are situated near Dhuan Bari Tehsil Malpura in Tonk District the construction of dam and canal was completed in 1880.

### *5.24.2 Important Features*

**(a) Catchment**

i. Gross 155.4 $km^2$

ii. Free 74 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 5.43 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 3992 ha

ii. CCA 2597 ha

iii. Irrigated Area 2101 ha

**(d) Storage Capacity**

i. Gross 14.70 $Mm^3$

ii. Live 14.53 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Discharge at head 1.27 cumecs & 0.70 cumecs

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|
| i. Wheat | 54.20% | 2673 |
| ii. Gram | 7.91% | 502 |
| iii. Barley | 24.20% | 1978 |
| iv. Oil Seeds | 11.77% | 769 |
| v. Pulses | 0.16% | 828 |
| vi. Other | 1.76% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.24.3 Present Status*

The project has been overall efficiency of 26.85%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The Chandsen Project canal system comprises of two main canals which off take directly from the dam. Throughout the entire canal system no cross regulators across main canals, big size outlets are drawing more water. They also require repairs.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed.
4. Existing lined section are damaged.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.25 Chaparwara Irrigation Project

### *5.25.1 Introduction*

Chaparwara Irrigation Project has been constructed on Local Drain which joins Mashi a tributary of Banas River, the dam and reservoir are situated near Dudu Tehsil town in Jaipur District the construction of dam and canal was completed in 1884.

### *5.25.2 Important Features*

**(a) Catchment**

i. Gross 834 $km^2$

ii. Free 749 $km^2$

**(b) Water Availability**

i. Design mean yield - 79.06 $Mm^3$

ii. Actual mean yield last 15 years 5.23 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 19218 ha

ii. CCA 11741 ha

iii. Irrigated Area 4932 ha

**(d) Storage Capacity**

i. Gross 53.20 $Mm^3$

ii. Live 53.20 $Mm^3$

**(e) Canals**

i. Main Canal at head Four

ii. Length 97.6 km (11.2 km, 48. km, 8.00 km & 30.40 km)

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 54.20% | 3214 |
| ii. | Gram | 7.91% | 912 |
| iii. | Barley | 24.20% | 3041 |
| iv. | Oil Seeds | 11.77% | 1219 |
| v. | Pulses | 0.16% | 1404 |
| vi. | Other | 1.76% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.25.3 Present Status*

The project has been overall efficiency of 32.99%. It is seen that actual irrigation is much below than designed due to following reasons.

1. The Chaparwara project canal system comprises of four main canals which off take directly from the dam. Throughout the entire canal system, there exist no minors, no cross regulators across main canals, big size outlets are drawing more water. They also require repairs.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed.
4. Existing lined section are damaged.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.26 Chauli Irrigation Project

### *5.26.1 Introduction*

Chauli Irrigation Project has been constructed on Chauli River which is a tributary of Kalisindh of Chambal Basin. The dam and reservoir are situated near village Himmatgarth of Pirawa Tehsil in Jhalawar District the construction of dam and canal was completed in 2006-2007.

### *5.26.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 222.00 $km^2$ |
| ii. | Free | 211.40 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 44.6 $Mm^3$ |
| ii. | Actual mean yield last 7 years | 27.92 $Mm^3$ |

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 8472 ha |
| ii. CCA | 7794 ha |
| iii. Irrigated Area | 8963 ha (Intensity 115%) |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 48.22 $Mm^3$ |
| ii. | Live | 41.87 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |

ii. Discharge at head 0.4397 cumecs & 4.175

iii. Length 19.50 km.

iv. Distributory/ Minor N.A

v. Length N.A

**(f) Cropping Pattern**

Designed N.A

**Present Cropping Pattern & Productivity** N.A

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.26.3 Present Status*

The project has been constructed recently and overall efficiency is 57% therefore there is no need to rehabilitate the project.

## 5.27 Chhapi Irrigation Project

### *5.27.1 Introduction*

Chhapi Irrigation Project has been constructed on Chhapi River which is a tributary of Chambal River the dam and reservoir are situated near village Delahanpur of Aklera Tehsil in Jhalawar District the construction of dam and canal was completed in 2005.

### *5.27.2 Important Features*

**(a) Catchment**

i. Gross 800.31 km (194 km in Rajasthan)

ii. Free 309.14 $km^2$ (194.5 $km^2$ in Rajasthan +10% from M.P. catchment) +10% renovation of balance of catchment

**(b) Water Availability**

i. Design mean yield - 98.10 $Mm^3$

ii. Actual mean yield last 7 years 59.23 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 9642 ha

ii. CCA 9375 ha

**(d) Irrigated Area**

i. Kharif (Cropping intensity 79.15%) 7421.16 ha

ii. Rabi (Cropping intensity 85.27%) 7991.82 ha

**Total** **15412.98 ha**

**(e) Storage Capacity**

i. Gross 82.57 $Mm^3$

ii. Live 73.57 $Mm^3$

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 3.32 cumecs & 1.30 cumecs |
| iii. | Length | 24.43 km & 9.81 km |
| iv. | Distributory/ Minor | 28 |
| v. | Length | 77.6 |

**(g) Cropping Pattern**

Designed

| **Rabi** | | **(% of CCA)** |
|---|---|---|
| i. | Wheat | 26.66 |
| ii. | Barley | 0.31 |
| iii. | Gram | 12.06 |
| iv. | Mustard | 11.95 |
| v. | Coriander | 26.16 |
| vi. | Maize | 0.02 |
| vii. | Orange | 7.90 |
| viii. | Rabi Other | 0.19 |
| | **Total** | **85.25** |
| **Kharif** | | **(% of CCA)** |
| i. | Maize | 15.81 |
| ii. | Jawaar | 15.81 |
| iii. | Oil Seeds | 0.06 |
| iv. | Soyabeen | 39.52 |
| v. | Ground Nut | 7.90 |
| vi. | Kharif Other | 0.05 |
| | **Total** | **79.16** |
| | **Grand Total** | **164.41** |

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 77.76% | 3337 |
| ii. | Barley | 0.04% | 2886 |
| iii. | Gram | 2.38% | 907 |
| iv. | Pulses | 0.09% | 860 |

| | | | |
|---|---|---|---|
| v. | Mustard (Oil Seeds) | 4.33% | 1377 |
| vi. | Vegetables, Spices, Rijka & Others | 15.39% | - |
| | **Total** | **100%** | |

**(h) Status of WUA** Not formed

**(i) Status of micro-irrigation** Nil

### *5.27.3 Present Status*

The project has been constructed recently and overall efficiency is 44% and this will further improve by formation of WUAs in operational management. Therefore there is no need to rehabilitate the project.

## 5.28 Chitoli Irrigation Project

### *5.28.1 Introduction*

Chitoli Irrigation Project has been constructed on Local Nallah near Chitoli Village which is a tributary of Sabi River the dam and reservoir are situated near village Chitoli of Virat Nagar Tehsil in Jaipur District the construction of dam and canal was completed in 1950.

### *5.28.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 153.6 $km^2$ |
| ii. | Free | 153.6 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 4.12 $Mm^3$ |

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 2539 ha | 2539 ha |
| ii. CCA | 2280 ha | 2280 ha |
| iii. Irrigated Area | 2038 ha | 2038 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 24.38 $Mm^3$ |
| ii. | Live | 22.23 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 3.0297 cumecs |
| iii. | Length | 8.66 km |
| iv. | Distributory/ Minor | 4 Nos. |
| v. | Length | 14.35 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|
| i. Wheat | 31.0% | 3214 |
| ii. Gram | 4.5% | 912 |
| iii. Barley | 30.0% | 3041 |
| iv. Mustard | 32.0% | 1028 |
| v. Other | 25.0% | - |

**(g) Status of WUA** 4 Nos. WUA exist 100%

**(h) Status of micro-irrigation** Nil

### *5.28.3 Present Status*

The project has been rehabilitated under RWSRP and the main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Barrel and existing pucca canal up to 1560m, and it is proposed to modify the barrel and rectangular masonry channel.
3. Providing CC lining up to 1560m in the canal.
4. Providing canal VRB in place of old pipe siphon which are damaged and does not carry required discharge.
5. Modifying old and deteriorated aqueduct and fall.
6. Construction of three minor off taking from Chitoli main canal to increase the irrigation area.
7. Desilting and resectioning of unused canal from 6.6 km to 8.66 km.
8. Strengthening of banks of unlined canal.
9. To develop awareness among the farmers for efficient use of water through formation of WUAs, thereby improving overall water management practices in the command. WUA will also take up the work of annual maintenance and confined resolution among the farmers as well as fixing assessment recovery of water charges and penalties etc.
10. Pipe out let have been replaced by gated outlet.
11. Repair & Construction of VRB.
12. 4 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.29 Dheel Irrigation Project

### *5.29.1 Introduction*

Dheel Irrigation Project has been constructed on Dheel River near Sislov which is a tributary of Banas River the dam and reservoir are situated near Sislov of Bonli Tehsil in Sawai Madhopur District the construction of dam and canal was completed in 1911.

### *5.29.2 Important Features*

**(a) Catchment**

i. Gross 785 $km^2$

ii. Free 689 $km^2$

**(b) Water Availability**

i. Design mean yield - 28.81 $Mm^3$

ii. Actual mean yield last 15 years 29.43 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 6640 ha

ii. CCA 6985 ha

iii. Irrigated Area 3350 ha

**(d) Storage Capacity**

i. Gross 27.73 $Mm^3$

ii. Live 27.73 $Mm^3$

**(e) Canals**

i. Main Canal One

ii. Discharge at head 4.98 cumecs

iii. Length 43.282 km

iv. Distributory/ Minor 39 Nos.

v. Length 50.08 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 42.86% | 3484 |
| ii. | Gram | 23.80% | 1044 |
| iii. | Oil Seeds | 19.05% | 1219 |
| iv. | Other | 14.29 | - |

**(g) Status of WUA** 4 Nos. WUA & 1DC exist

**(h) Status of micro-irrigation** Nil

### *5.29.3 Present Status*

The project has overall efficiency of 32.99%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one main canal which off take directly from the dam. Existing lined section are damaged and mostly reaches which are unlined requires resectioning and lining.
2. No of outlets are over capacity.
3. Banks of canals are deformed /eroded.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.30 Dindoli Irrigation Project

### *5.30.1 Introduction*

Dindoli Irrigation Project has been constructed on Local Drain which joins Berach a tributary of Banas River, the dam and reservoir are situated near Dindoli Tehsil Rashmi of Chittaurgarh District the construction of dam and canal was completed in 1965.

### *5.30.2 Important Features*

**(a) Catchment**

i. Gross 21 $km^2$

ii. Free 20.72 $km^2$

**(b) Water Availability**

i. Design mean yield - 1.86 $Mm^3$

ii. Actual mean yield last 14 years 1.78 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 2333 ha

ii. CCA 2056 ha

iii. Irrigated Area 850 ha

**(d) Storage Capacity**

i. Gross 7.52 $Mm^3$

ii. Live 7.45 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Discharge at head 1.27 cumecs & 0.70 cumecs

iii. Total length of canals 7.65 km & 8.58 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 56.95% | 3295 |
| ii. | Gram | 2.48% | 946 |
| iii. | Barley | 3.87% | 2886 |
| iv. | Oil Seeds | 33.73% | 1223 |
| v. | Other | 2.47% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.30.3 Present Status*

The project has overall efficiency of 13%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The Dindoli project canal system comprises of two main canals which off takes directly from the dam. The entire canal system have no cross regulators across main canals, big size outlets are drawing more water. They also require repairs.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed.
4. Existing lined section are damaged.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.31 Dugari Irrigation Project

### *5.31.1 Introduction*

Dugari Irrigation Project has been constructed on Local Nallah which joins Mej River of Chambal Basin near village Dugari the dam and reservoir are situated near Dugari of Nainwa Tehsil in Bundi District the construction of dam and canal was completed in 1955.

### *5.31.2 Important Features*

**(a) Catchment**

i. Gross 112.66 $km^2$

ii. Free 106.32 $km^2$

**(b) Water Availability**

i. Design mean yield - 13.89

ii. Actual mean yield last 15 years 4.34 $Mm^3$

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 2877 ha |
| ii. | CCA | 2251 ha |
| iii. | Irrigated Area | 1560 ha |
| **(d) Storage Capacity** | | |
| i. | Gross | 18.08 $Mm^3$ |
| ii. | Live | 18.08 $Mm^3$ |
| **(e) Canals** | | |
| i. | Main Canal | One |
| ii. | Discharge at head | 2.436 cumecs |
| iii. | Length | 8.99 km |
| **(f) Cropping Pattern** | | |
| | Designed | NA |

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 46.78% | 3394 |
| ii. | Gram | 8.44% | 739 |
| iii. | Barley | 0.28% | 3061 |
| iv. | Oil Seeds | 13.60% | 1109 |
| v. | Sugarcane | 19.36% | 40284 |
| vi. | Other | 11.54% | - |

| | |
|---|---|
| **(g) Status of WUA** | Not formed |
| **(h) Status of micro-irrigation** | Nil |

### *5.31.3 Present Status*

The project has overall efficiency of 24.28%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one main canal which off take from the dam.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed and require resectioning.
4. Existing lined section are damaged and some of reaches are unlined.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.32 Gagrain Irrigation Project

### *5.32.1 Introduction*

Gagrain Irrigation Project has been constructed on Ahu River which is a tributary of Kalisindh River of Chambal Basin. The dam and reservoir are situated near village Kalapipal of Pirwa Tehsil in Jhalawar District the construction of dam and canal was completed in 2007.

### *5.32.2 Important Features*

**(a) Catchment**

i. Gross 581.75 $km^2$

ii. Free 569.40 $km^2$

**(b) Water Availability**

i. Design mean yield - 56.99 $Mm^3$

ii. Actual mean yield last 15 years N.A

**(c) Command Area** **Designed**

i. GCA 10662 ha

ii. CCA 7943 ha

**(d) Irrigated Area**

i. Kharif 2961 ha

ii. Rabi 6713 ha

**(e) Storage Capacity**

i. Gross 52.60 $Mm^3$

ii. Live 47.10 $Mm^3$

**(f) Canals**

i. Main Canal One

ii. Discharge at head 4.81 cumecs

iii. Length 2.8651 km

**(g) Cropping Pattern**

**Designed Cropping Pattern**

| Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|
| **Kharif** | | |
| i. Vegetables & Fruits | 31% | 221 |
| ii. Kharif Pulses | 38% | 8400 |
| iii. Others | 31% | - |
| **Rabi** | | |
| i. Wheat | 21% | 3337 |

| | | | |
|---|---|---|---|
| ii. | Gram | 10% | 907 |
| iii. | Barley | 1% | 2774 |
| iv. | Vegetables & Fruits | 6% | 221 |
| v. | Mustard | 8% | 1377 |
| vi. | Coriander | 46% | 1098 |
| vii. | Other | 8% | - |

**(h) Status of WUA** Not formed

**(i) Status of micro-irrigation** Nil

### *5.32.3 Present Status*

The project has been constructed recently and overall efficiency is 57% therefore there is no need to rehabilitate the project.

## 5.33 Galwa Irrigation Project

### *5.33.1 Introduction*

Galwa Irrigation Project has been constructed on Galwa River near Uniara which is a tributary of Banas River the dam and reservoir are situated near Uniara of Uniara Tehsil in Tonk District the construction of dam and canal was completed in 1960.

### *5.33.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 394 $km^2$ |
| ii. | Free | 394 $km^2$ |

**(b) Water Availability**

i. Design mean yield - 61.8

ii. Actual mean yield last 15 years 27.23 $Mm^3$

**(c) Planned Utilization (Including losses)**

| | | |
|---|---|---|
| i. | Domestic water | 0.42 $Mm^3$ |
| ii. | Irrigation water | 39.8 $Mm^3$ |
| iii. | Industrial | 0.51 $Mm^3$ |

| **(d) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | N.A | N.A |
| ii. | CCA | 13391 ha | 13391 ha |
| iii. | Irrigated Area | 5903 ha | 5903 ha |

**(e) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 48.70 $Mm^3$ |
| ii. | Live | 48.36 $Mm^3$ |

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 7.4172 cumecs |
| iii. | Length | 39.32 km |
| iv. | Distributory/Minor | 14 Nos. |
| v. | Length | 68.13 km |

**(g) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 36.5% | 2673 |
| ii. | Gram | 2.8% | 502 |
| iii. | Barley | 2.9% | 1978 |
| iv. | Oil Seeds | 55.2% | 769 |
| v. | Pulses | 1.5% | 828 |
| vi. | Other | 1.1% | - |

**(h) Status of WUA** 15 Nos. WUA &1DC exist

**(i) Status of micro-irrigation** Nil

### *5.33.3 Present Status*

The project has been rehabilitated under RWSRP in year 2008 and presently the overall efficiency is 46% which will further improve by active involvement of WUAs in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.34 Galwania Irrigation Project

### *5.34.1 Introduction*

Galwania Irrigation Project has been constructed on Local Nallah which joins Chakan River of Chambal Basin near village Galwania the dam and reservoir are situated near Galwania of Uniara Tehsil in Tonk District the construction of dam and canal was completed in 1954.

### *5.34.2 Important Features*

**(a) Catchment**

i. Gross 112.66 $km^2$

ii. Free 106.32 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 8.20 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 2435 ha

ii. CCA 2257 ha

iii. Irrigated Area 2257 ha

**(d) Storage Capacity**

i. Gross 12.51 $Mm^3$

ii. Live 1.39 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Discharge at head 0.70 cumecs & 0.542 cumecs

iii. Length 9.67 km & 8.35 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|
| **Kharif** | | |
| i. Jawar | 42.80% | 454 |
| ii. Ground Nut | 14.28% | 558 |
| iii. Maize | 28.57% | 258 |
| iv. Others | 14.35% | - |
| **Rabi** | | |
| i. Wheat | 43.18% | 2673 |
| ii. Gram | 15.91% | 502 |
| iii. Barley | 4.54% | 1978 |
| iv. Oil Seeds | 29.55% | 769 |
| v. Other | 6.82% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.34.3 Present Status*

The project has overall efficiency of 14.50%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.35 Gambhiri Irrigation Project

### *5.35.1 Introduction*

Gambhiri Irrigation Project has been constructed on Gambhiri River which is a tributary of Berach River of Banas Basin. The dam and reservoir are situated near Mohata of Nimbahera Tehsil in Chittaurgarh District. The construction of dam and canal was completed in 1957.

### *5.35.2 Important Features*

**(a) Catchment**

i. Gross 1036 $km^2$ (570 $km^2$ in Rajasthan & 466 $km^2$ in M.P.)

ii. Free 932 $km^2$

**(b) Water Availability**

i. Design mean yield - 150 $Mm^3$

ii. Actual mean yield last 15 years 31.6 $Mm^3$

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 8385 ha | 8385 ha |
| ii. CCA | 7575 ha | 7575 ha |
| iii. Irrigated Area | 5466 ha | 3970 ha |

**(d) Storage Capacity**

i. Gross 55.01 $Mm^3$

ii. Live 53.48 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Discharge at head 2.22 cumecs & 3.29 cumecs

iii. Length 34.8 km & 41.02 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 75.44% | 3295 |
| ii. | Barley | 4.17% | 2886 |
| iii. | Gram | 2.78% | 946 |
| iv. | Mustard | 9.68% | 1223 |
| v. | Other (Vegetables, Rijika & Pulses) | 7.93% | - |

**(g) Status of WUA** 9 Nos. WUA &1DC

**(h) Status of micro-irrigation** Nil

### *5.35.3 Present Status*

The project has been rehabilitated under RWSRP in 2009 and presently the overall efficiency is 37% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 15WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.36 Gang Canal Project

### *5.36.1 Introduction*

Gang Canal project was first prepared in 1917, and later revised in 1920 and 1922. It envisaged a canal with full supply capacity of 60.71 $m^3$/sec (2144 cusecs), with a bottom width of 27.74 metres (91 ft), intended to extend irrigation benefits to a gross area of 305,500 ha (755,000 acres.) with a CCA of 263,300 ha (650,588 acres). Canal construction started in 1922 and was completed in April 1928. The canal in its reach in Punjab, and up to Shivpur Head, where it bifurcates into Feeder Canal and Laxminarayanji Branch canal, is lined with lime concrete. The Punjab portion of the canal is called Bikaner Canal, and in Rajasthan - Gang Canal. The actual water received by Rajasthan is shown in Annex 5.

### *5.36.2 Important Features*

**(a) Total water allocation to Rajasthan** 1,776.21 $Mm^3$

i. Water allocation for irrigation 1,659.03 $Mm^3$

ii. Water reserved for non-agricultural use 117.18 $Mm^3$

**(b) Command Area**

i. Total Culturable Command Area 4.43 Lakh ha

ii. Command area under flow irrigation 3.56 Lakh ha

**(c) Intensity of Irrigation (Design)**

i. Intensity of irrigation in command area under flow 79%

**(d) Main Canal**

i. Discharge at head 85.69cumecs,

ii. Length

Bikaner Canal 109km (98.6km in Punjab &10.72km in Rajasthan)

Gang Canal

iii. Length of system 1154km

**(e) Status of WUA** Formed

**(f) Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Kharif** | | |
| i. | Cotton | 8.18% | 1219 |
| ii. | Pulses | 4.76% | 515 |
| iii. | Bajra | 4.57% | 1631 |
| iv. | Ground Nuts | 7.53% | 1935 |
| v. | Paddy | 0.20% | 5119 |
| vi. | Gawar | 70.51% | 829 |
| vii. | Fodder | 4.25% | - |
| viii. | Other | 0.50% | - |
| | **Rabi** | | |
| i. | Wheat | 23.14% | 3537 |
| ii. | Gram | 46.21% | 575 |
| iii. | Mustard | 21.47% | 1588 |
| iv. | Barley | 2.16% | 3078 |
| v. | Fodder | 3.69% | - |
| vi. | Others | 3.33% | - |

**(g) Status of micro-irrigation** Nil

### *5.36.3 Present Status*

Gang Canal system has been receiving adequate water since the late nineteen-seventies, when Pong Dam started storing River Beas water. This was because

Rajasthan Canal was not complete, and Bikaner Canal was the only established system in Rajasthan which could make maximum benefit from the water allocation to Rajasthan. However, with the progressive completion of IGNP, the situation is likely to change, as IGNP areas has started utilizing their full share of supplies. The allocation of water for Gang Canal would be within its allocated share of 1.78 $Bm^3$ in a mean year. Although the system is well developed and is operating satisfactorily, there is scope of improving its performance by attempting to optimize the utilization of available supplies, improving crop productivity, reducing water losses from canals, distributaries, minor canals and Water Courses, and by resorting, to the extent possible, to conjunctive use of surface and ground water. The most important and urgent task is to carry out the work of re-lining and re-sectioning of the main Bikaner canal in Punjab, where the existing lining has deteriorated and requires urgent attention. This is necessary to save the existing system, even if modernization of the canal system is not done. Therefore the modernization has been started by the Irrigation Department, Under RWSRP&AIBP Programme all the canals are to be lined, and canal losses are expected to be substantially reduced. 0.2 m (0.65 ft) per year. Since inception of the project the groundwater table in the project area has risen. Some reduction in the steady rise of the groundwater table has, however, been observed during last few years, which could be due to an increasing use of groundwater for irrigation. As regards the quality of water, considering salinity and alkalinity hazards, the subsoil water found in thin belts on both sides of irrigation canals has so far been considered suitable for irrigation, but its suitability is decreasing considerably towards farther areas in the Command.

The project is being rehabilitated under RWSRP&AIBP and presently the overall efficiency is 38.32% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in unlined Reaches and lining of water courses.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

   As this system is being rehabilitated under RWSRP&AIBP. Therefore there is no need for further rehabilitation.

## 5.37 Girolia Irrigation Project

### *5.37.1 Introduction*

Girolia Irrigation Project has been constructed on Bandi Nallah a tributary of Luni River. The dam and reservoir are situated near Girolia in Rohat Tehsil in Pali District the construction of dam and canal was completed in 1976.

### *5.37.2 Important Features*

**(a) Catchment**

i. Gross 691.0 $km^2$

ii. Free 691.0 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years No adequate water received in dam for the last 15 years

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 2540 ha | 2540 ha |
| ii. CCA | 2429 ha | 2429 ha |
| iii. Irrigated Area | 1215ha | No Irrigation have been done for the last 15years |

**(d) Storage Capacity**

i. Gross 4.95 $Mm^3$

ii. Live 4.2 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Length 5.4 km

iii. Distributory/ Minor 2 Nos.

iv. Length 12.21 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity** N.A

**(g) Status of micro-irrigation** Nil

### *5.37.3 Present Status*

It is reported that from the last 15 years, there has been practically no inflow in the reservoir. Therefore as far as surface water project is concerned this stands virtually abandoned, There is no other source of water from which water can be diverted to this dam for irrigation in the command hence no action for rehabilitation is needed.

## 5.38 Gopalpura Irrigation Project

### *5.38.1 Introduction*

Gopalpura Irrigation Project has been constructed on Revli & Gherawali Rivers which is a Tributaries of Kul River of Chambal Basin the dam and reservoir are situated near Gopalpura of Kishanganj Tehsil in Baran District the construction of dam and canal was completed in 1980.

### *5.38.2 Important Features*

**(a) Catchment**

i. Gross 242 $km^2$

ii. Free 229.22 $km^2$

**(b) Water Availability**

i. Design mean yield - NA

ii. Actual mean yield last 15 years 27.29 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 5718 ha

ii. CCA 3557.0 ha

iii. Irrigated Area 3410 ha

**(d) Storage Capacity**

i. Gross 32.64 $Mm^3$

ii. Live 32.01 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Discharge at head 3.12 cumecs & 0.14 cumecs

iii. Length 21.750 km & 1.800 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 97.28% | 3761 |
| ii. | Gram | 0.15% | 1029 |
| iii. | Barley | 0.11% | 3060 |
| iv. | Oil Seeds | 1.58% | 1441 |
| v. | Coriander | 0.84% | 1265 |
| vi. | Other | 0.04% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.38.3 Present Status*

The project has overall efficiency of 45.07%. It is seen that actual overall efficiency is below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and minors are unlined.

4. WUA are not formed.
5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.39 Gosunda Project

### *5.39.1 Introduction*

Gosunda Project has been constructed on Bearch River which joins Banas River, the dam and reservoir are situated near Panchdina of Chittaurgarh Tehsil in Chittaurgarh District the construction of dam and canal was completed in 1990.

### *5.39.2 Important Features*

**(a) Catchment**

i. Gross 4662 $km^2$

ii. Free 1869 $km^2$

**(b) Water Availability**

i. Design 90% dependability yield - 148.35 $Mm^3$

ii. Actual mean yield last 15 years N.A

**(c) Command Area** **Designed** (Originally planned later on dam has been transferred to HZL)

i. GCA 16137 ha

ii. CCA 10000 ha

**(d) Storage Capacity**

i. Gross 101.28 $Mm^3$

ii. Live 66.98 $Mm^3$

**(e) Planned Utilization**

i. Domestic water 8.49 $Mm^3$

ii. M/S HZL 42.47 $Mm^3$

iii. Power generation 42.47 $Mm^3$

iv. Govt. reserved 8.5 $Mm^3$

**(f) Status of micro-irrigation** Nil

### *5.39.3 Present Status*

As the project has been transferred to HZL and no irrigation has been provided therefore no action for rehabilitation is needed.

## 5.40 Gudha Irrigation Project

### *5.40.1 Introduction*

Gudha Irrigation Project has been constructed on Mej River which is a tributary of Chambal River the dam and reservoir are situated near village Gudha of Hindoli Tehsil in Bundi District the construction of dam and canal was completed in 1956.

### *5.40.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 744.96 $km^2$ |
| ii. | Free | 558.16 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 96.43 $Mm^3$ |
| ii. | Actual mean yield last 15years | 59.23 $Mm^3$ |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 18141 ha |
| ii. | CCA | 11380 ha |

**(d) Irrigated Area**

| | | |
|---|---|---|
| i. | Kharif (Cropping intensity 28.5.0%) | 3243 ha |
| ii. | Rabi (Cropping intensity 70.00%) | 7966 ha |
| | **Total** | 11209 ha |

**(e) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 95.56 $Mm^3$ |
| ii. | Live | 93.58 $Mm^3$ |

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 7.32 cumecs & 4.09 cumecs |
| iii. | Length | 28.04 km & 26.21 km |
| iv. | Branch/Distributory/ Minor | 20 |
| v. | Length | 102.55 km |

**(g) Cropping Pattern**

Present Cropping Pattern & Productivity (At present project canals are operated for Rabi only.)

| | **Crops Rabi** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 83.85% | 3394 |
| ii. | Barley | 1.16% | 3061 |
| iii. | Gram | 0.70% | 739 |
| iv. | Pulses | 1.63% | 1496 |
| v. | Mustard (Oil Seeds) | 5.58% | 1109 |
| vi. | Vegetables, Spices, Rijka & Others | 7.07% | - |
| | **Total** | **100%** | |

**(h) Status of WUA** 19 Nos. WUA ,3DC & 1PC exist

**(i) Status of micro-irrigation** Nil

### *5.40.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 46.2% which will further improve by active involvement of WUAs in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. 19 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.41 Gurgaon Canal Project

### *5.41.1 Introduction*

The Gurgaon Canal Project is constructed to cater water from Yamuna to irrigate 44838 ha in Bharatpur District. Gurgaon Canal off taking at mile 5 of Agra Canal which was have 92.03 $m^3$/sec capacity for U.P 45.3 $m^3$/sec capacity for Haryana and 14.16 $m^3$/sec for Rajasthan to be delivered at Rajasthan border.

The salient features are given below.

### *5.41.2 Important Features*

**(a) Command Area**

Total Culturable Command Area 44838 ha

**(b) Intensity of Irrigation**

**(c) Main Canal**

i. Discharge at head 14.16 cumecs

ii. Length 53.4 km

**(d) Status of WUA** Not formed

**(e) Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 31% | 3921 |
| ii. | Gram | 4.5% | 1197 |
| iii. | Barley | 30.0% | 3178 |
| iv. | Mustard | 32.0% | 1730 |
| v. | Maithi | 1.0% | 1167 |

vi. Other 1.5% -

**(f) Status of micro-irrigation** Nil

### *5.41.3 Present Status*

The existing canal capacity available for utilization of Yamuna water in state is 14.16 cumecs against the allocation of 27.77 cumecs therefore it is proposed to construct a canal parallel to the existing Gurgaon canal, having a common bank with it, from the Rajasthan-Haryana border to km 53.4 (i.e. the tail end of the existing Gurgaon Canal). Thereafter it shall extend up to the existing Ajan Bund.

The canal would supply irrigation water to areas between the existing end of Gurgaon Canal and the area commanded by Ajan Bund. Other features of the proposed Gurgaon canal would be as follows:

| | |
|---|---|
| Discharge at head reach | 13.61 $m^3$/sec |
| Total length | 96.00 km |
| CCA | 33959 ha |

As this work will be treated as new work therefore Gurgaon canal has not considered for rehabilitation.

## 5.42 Harish Chandra Sagar Project

### *5.42.1 Introduction*

The Harish Chandra Sagar Project has been constructed across River Kalisindh, a tributary of Chambal River. It is a run off the river scheme, which mainly utilizes non-monsoon flows for irrigation. A pick up weir has been constructed near village Hitcher of Khanpur Tehsil of Jhalawar District to divert water into the right main canal. This was one of the first medium/major projects taken up for construction, in 1954, after formation of the State of Rajasthan.

### *5.42.2 Important Features*

**(a) Catchment**

i. Gross 11975 $km^2$ (3777.4 $km^2$ in Rajasthan)

ii. Free 10773 $km^2$

**(b) Water Availability**

i. Mean yield (computed) 1881.37 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 22472 ha

ii. CCA 17973 ha

**(d) Irrigated Area**

i. Designed 14741 ha (60% in Rabi & 20% in Kharif)

ii. Present Designed 12595 ha (70% of CCA)

**(e) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 9.60% | 3337 |
| ii. | Coriander | 45.06% | 1098 |
| iii. | Mustard | 38.44% | 1377 |
| iv. | Rabi Pulses | 6.36% | 828 |
| v. | Others | 0.54% | - |
| | **Total** | **100%** | |

**(f) Status of WUA** Not formed

**(g) Status of micro-irrigation** Nil

### *5.42.3 Present Status*

The pickup weir completed in 1956 breached in flood season of the same year. The breached portion was restored in the year 1957. The pickup weir again breached in 1960 and was again restored in 1962. The canal system was partially constructed by this time and irrigation was started from the project in 1962-63. The irrigation from the project continued till 1969, when the pickup weir again breached due to unprecedented floods in the river. During this flood, low lying areas of Jhalawar (a district town) and villages on right bank of the river faced severe flood threat.

The design of the pickup weir and the project proposals and designs were reviewed and to avoid possible flooding of Jhalawar town, it was decided to lower the top of the weir along with bed level of the canal so that it could carry full discharge with lower water level in the weir. This could be managed as the command of the canal started about 9 km downstream and was lower than the lowered level of the pickup weir. After making these modifications, irrigation from the project was restarted.

It has been seen that actual overall efficiency is much below than designed due to following reasons.

1. Cropping pattern being not suitable to monthly water availability and conjunctive use of groundwater.
2. Inefficient irrigation practices.
3. Inadequate water availability for diversion in critical non monsoon months.
4. WUAs are not formed.
5. Warabandi system is not enforced.

As Harish Chandra Sagar command has been linked to the canals of newly proposed Kalisindh Project therefore the project has not been considered for rehabilitation.

## 5.43 Hemawas Irrigation Project

### *5.43.1 Introduction*

Hemawas Irrigation Project has been constructed on Khari, Bandi & Sumar Rivers. The dam and reservoir are situated near Pali in Pali Tehsil in Pali District the construction of dam and canal was completed in 1911.

### *5.43.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1125 $km^2$ |
| ii. | Free | 907 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 23.88 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 9115 ha | 9115 ha |
| ii. | CCA | 8704 ha | 8704 ha |
| iii. | Irrigated Area | 6093 ha | 5299 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 62.53 $Mm^3$ |
| ii. | Live | 62.53 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Length | km |
| iii. | Distributory/ Minor | 3 Nos. |
| iv. | Total Length of System | km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 36.46% | 1980 |
| ii. | Raida | 59.72% | 932 |
| iii. | Other | 3.82% | - |

**(g) Status of WUA** 14 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.43.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 35% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water courses d/s of outlet in 15m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 14WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.44 Hingonia Irrigation Project

### *5.44.1 Introduction*

Hingonia Irrigation Project has been constructed on Bandi River which is a tributary of Mashi River of Banas Basin. The dam and reservoir are situated near Hingonia of Dudu Tehsil in Jaipur District. The construction of dam and canal was completed in 1900.

### *5.44.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1037 $km^2$ |
| ii. | Free | 407 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 1.47 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 3031 ha | 3031 ha |
| ii. | CCA | 2078 ha | 2078 ha |
| iii. | ICA | 1238 ha | 1238 ha |
| iv. | Irrigated Area | 1238 ha | N.A |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 7.5 $Mm^3$ |
| ii. | Live | 7.5 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Three |
| ii. | Discharge at head | 0.42, 0.5662 & 0.5662 cumecs |
| iii. | Length | 12 km, 1.26 & 12 km |

**(f) Cropping Pattern**

| | |
|---|---|
| Designed | NA |
| **Present Cropping Pattern & Productivity** | No irrigation for the last 15 years |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.44.3 Present Status*

It is reported that from the last 12 years, there has been practically no inflow in the reservoir. Therefore as far as irrigation is concerned this stands virtually abandoned hence no action for rehabilitation is needed.

## 5.45 Indira Gandhi Nahar Project

### *5.45.1 Introduction*

The Indira Gandhi Nahar Project is an excellent example of courageous fight of man against oddness of nature. Aim of this ambitious project is to irrigate the thirsty desert Land of Rajasthan with Himalaya's water and provide drinking water to inhabitants of this area.

Origin of this canal is from Harike Barrage situated in Punjab. From Harike, 204 km. long Indira Gandhi Feeder off-takes, which have 170 km, length in Punjab & Haryana and balance 34 km. in Rajasthan, this canal enters at Hanumangarh. From tail of Indira Gandhi Feeder 445 km. long Indira Gandhi main canal starts, which passes through Shri Ganganagar and Bikaner Districts and end at Mohangarh in Jaisalmer.

The project has been divided administratively in two stages. The 393 km. Long canal portion, from Harike Barrage to Pugal, it's up to 620 RD., with its distribution system (excluding Sahwa lift) is called stage I. The area downstream to R.D. 620 of Main canal with its distribution system (including Sahwa lift) is in stage-II. The actual water received by Rajasthan is shown in Annex 5.

The salient features are given below.

### *5.45.2 Important Features*

**(a) Total water allocation to Rajasthan** 9,362.11 $Mm^3$

| | | |
|---|---|---|
| i. | Water allocation for irrigation | 8,288.98 $Mm^3$ |
| ii. | Water reserved for non-agricultural use | 1,073.13 $Mm^3$ |

**(b) Command Area**

| | | |
|---|---|---|
| i. | Total Culturable Command Area | 16.17 Lakh ha |
| (a) | Flow irrigated area | 12.07 Lakh ha |

(b) Lift irrigated area 4.10 Lakh ha

**(c) Intensity of Irrigation**

i. Flow irrigated area 110%

ii. Lift irrigated area 110%

**(d) Main Canal**

i. Discharge at head 523.93 cumecs,(At Harike Barrage)

ii. Length 445 km

iii. Length of system 9413 km

**(e) Status of WUA** Formed

**(f) Status of micro-irrigation** Pilot project in 27447 ha (1.70%)

**(g) Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| | **Kharif** | | |
| i. | Cotton | 8.18% | 345 |
| ii. | Pulses | 4.76% | 423 |
| iii. | Bajra | 4.57% | 1159 |
| iv. | Ground Nuts | 7.53% | 1744 |
| v. | Paddy | 0.20% | 5119 |
| vi. | Gawar | 70.51% | 4225 |
| vii. | Fodder | 4.25% | 415 |
| viii. | Other | 0.50% | - |
| | **Rabi** | | |
| i. | Wheat | 23.14% | 3262 |
| ii. | Gram | 46.21% | 575 |
| iii. | Mustard | 21.47% | 1205 |
| iv. | Barley | 2.16% | 3078 |
| v. | Fodder | 3.69% | 451 |
| vi. | Others | 3.33% | - |

### *5.45.3 Present Status*

The Indira Gandhi Nahar Project is ongoing project. Stage I has almost completed in1976. In Stage II for which construction works in Baba Ramdev Sub branch and three lift schemes are under progress.

For efficient and optimum use of water available in project, it is proposed to establish sprinkler irrigation system in lift schemes of stage-II. A pilot project was taken up in 27447 ha area. Out of which works has almost completed in 25419 ha area. Constitution of 23 W.U.A. has been done out of 25 W.U.A. proposed in this

area and irrigation with sprinkler has been started in11488 ha after taking electric connections.

Apart from Sprinkler irrigation, SCADA system has been installed in project for effective control on water regulation and distribution in canal.

In view of above the command area is not fully open and performance of project is to be reviewed so this project has not been considered for rehabilitation.

## 5.46 Jaisamand Irrigation Project (Udaipur)

### *5.46.1 Introduction*

Jaisamand Irrigation Project has been constructed on Gomti River which is a tributary of Som River of Mahi Basin the dam and reservoir are situated near Gatod of Sarda Tehsil in Udaipur District. The construction of dam and canal was completed in 1730.

### *5.46.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1813 $km^2$ |
| ii. | Free | 1654 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 164.45 $Mm^3$ |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 372821 ha |
| ii. | CCA | 16000 ha |
| iii. | ICA | 14400 ha |
| iv. | Intensity of Irrigation | 90% |
| v. | Irrigated Area | 16000 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 142.02 $Mm^3$ |
| ii. | Live | 132.26 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 7.56 cumecs & 153 cumecs |
| iii. | Length | 51.09 km & 22.86 km |
| iv. | Distributory/ Minor/Sub minors | 90 Nos. |
| v. | Length | 291.450 km |

**(f) Cropping Pattern**

Designed

| | | |
|---|---|---|
| i. | Soya (Kharif) | 11% |

ii. Wheat (Rabi) 22.22%

iii. Mustard (Rabi) 22.22%

iv. Gram (Rabi) 5.56%

v. Moong (Jayad) 39%

**Present Cropping Pattern & Productivity (Rabi)**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 81.98% | 2340 |
| ii. | Barley | 8.47% | 1807 |
| iii. | Gram | 8.69% | 1060 |
| iv. | Mustard | 0.29% | 891 |
| v. | Other (Vegetables, Rijika & Pulses) | 0.57% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.46.3 Present Status*

The project has overall efficiency of 33.48%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. Canal capacities are inadequate to cope with peak demand.
2. Few aqueducts are losing strength, needs guniting.
3. Canals are damaged and require repair.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.47 Jaisamand Irrigation Project (Alwar)

### *5.47.1 Introduction*

Jaisamand Irrigation Project has been constructed on Ruparail River near Alwar the dam and reservoir are situated near Alwar of Alwar Tehsil in Alwar District the construction of dam and canal was completed in 1889.

### *5.47.2 Important Features*

**(a) Catchment**

i. Gross 179.74 $km^2$

ii. Free 163 $km^2$

**(b) Water Availability**

i. Design mean yield - NA

ii. Actual mean yield last 15 years 8.47 $Mm^3$

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 5590 ha | 5590 ha |
| ii. CCA | 4790 ha | 4790 ha |
| iii. Irrigated Area | 2784 ha | 2784 ha |

**(d) Storage Capacity**

i. Gross 26.96 $Mm^3$

ii. Live 24.92 $Mm^3$

**(e) Canals**

| | |
|---|---|
| i. Main Canal | Two |
| ii. Discharge at head | 3.66 cumecs & 2.317 cumecs |
| iii. Length | 4.65 km & 1.73 km |
| iv. Distributaries/ Minor | 7 Nos. |
| v. Length | 19.25 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 31.0% | 3749 |
| ii. | Gram | 4.5% | 1089 |
| iii. | Barley | 30.0% | 3709 |
| iv. | Mustard | 32.0% | 1563 |
| v. | Maithi | 1.0% | 1229 |
| vi. | Other | 1.5% | - |

**(g) Status of WUA** 6 Nos. WUA 2 DC exist

**(h) Status of micro-irrigation** Nil

### *5.47.3 Present Status*

The project has been rehabilitated under RWSRP in year 2010 and presently the overall efficiency is 35% which will further improv by active involvement of WUAs in operational management the main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Pipe out let have been replaced to gate.
4. Repair & Construction of VRB.

5. 6 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

   As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.48 Jakham Irrigation Project

### *5.48.1 Introduction*

Jakham Irrigation Project has been constructed on Jakham River which is a tributary of Som River of Mahi Basin the dam and reservoir are situated near Annupura of Dhariawad Tehsil in Pratapgarh District. The construction of dam and canal was completed in 1986.

### *5.48.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1807 $km^2$ |
| ii. | Free | 1010 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 212.25 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 97.48 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 38901 ha | 38901 ha |
| ii. | CCA | 28319 ha | 28319 ha |
| iii. | ICA | 23505 ha | 23505 ha |
| iv. | Intensity of Irrigation | 83% (59% Rabi + 24% Kharif) | |
| v. | Irrigated Area | 23505 ha | 10447 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 142.02 $Mm^3$ |
| ii. | Live | 132.26 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 3.54 cumecs & 7.53 cumecs |
| iii. | Length | 34.12 km & 39.90 km |
| iv. | Distributory/ Minor | 74 Nos. |
| v. | Length | NA |

**(f) Cropping Pattern**

| | |
|---|---|
| Designed | NA |

**Present Cropping Pattern & Productivity (Rabi)**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 81.98% | 3314 |
| ii. | Barley | 0.47% | 2014 |
| iii. | Gram | 8.69% | 1051 |
| iv. | Mustard | 0.29% | 1223 |
| v. | Other (Vegetables, Rijika & Pulses) | 0.57% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.48.3 Present Status*

The project has overall efficiency of 41%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. Canal capacities are inadequate to cope with peak demand.
2. Few aqueducts are losing strength, needs guniting.
3. Canals are damaged and required repairing.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.49 Jaswant Sagar Irrigation Project

### *5.49.1 Introduction*

Jaswant Sagar Irrigation Project has been constructed Luni River. The dam and reservoir are situated near Bilara in Mandore Tehsil in Jodhpur District the construction of dam and canal was completed in 1899.

### *5.49.2 Important Features*

**(a) Catchment**

i. Gross 3328 $km^2$

ii. Free 1720.32 $km^2$

**(b) Water Availability**

i. Design mean yield - 47.43 $Mm^3$

ii. Actual mean yield last 15 years 6.64 $Mm^3$

| (c) Command Area | | Designed | Actual |
|---|---|---|---|
| i. | GCA | 7245 ha | 7245ha |
| ii. | CCA | 6380 ha | 6380 ha |
| iii. | Irrigated Area | 5463 ha | |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 52.78 $Mm^3$ |
| ii. | Live | 52.58 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | |
| ii. | Discharge at head | 1.9 cumecs |
| iii. | Length | 10.67 km |
| iv. | Distributory/ Minor | 2 Nos. |
| v. | Length | 12.21 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity** N.A

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.49.3 Present Status*

Jaswant sagar was breached in 2007 at present dam and canal under construction therefore project is not considered for rehabilitation.

## 5.50 Jawahar Sagar Project

### *5.50.1 Introduction*

The Jawahar Sagar Project is a second dam of the Chambal Valley Development Project- A joint undertaking of the government of Madhya Pradesh and Rajasthan to utilise the water of Chambal River and Hydel power generation thereto are to be shared between Madhya Pradesh and Rajasthan in equal proportion. Jawahar Sagar dam has been constructed in 1973 near Kota in Rajasthan, the dam is located 26 km downstream of the Ranapratap Sagar dam and 29 km upstream of Kota City. The power plant at Jawahar Sagar is located below of the dam and has an installed capacity of 99 MW (3X33MW).

### *5.50.2 Important Features*

**(a) Catchment Area**

| | | |
|---|---|---|
| i. | Gross Catchment Area | 27196 $km^2$ (2484 $km^2$ with in Rajasthan) |
| ii. | Free Catchment Area | 2331 $km^2$ |

**(b) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 64.84 $Mm^3$ |
| ii. | Live | 52.00 $Mm^3$ |

**(c) Status of micro-irrigation** Nil

### *5.50.3 Present Status*

The Jawahar Sagar Project is a balancing reservoir for power generation and dam is safe to receive water therefore project is not considered for rehabilitation.

## 5.51 Jawai Irrigation Project

### *5.51.1 Introduction*

Jawai Project has been constructed on Jawai River which is a tributary of Luni River near Jawai Band railway station. The dam and reservoir are situated in Pali Tehsil in Pali District. The construction of dam and canal was completed in 1957.

### *5.51.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 787.36 $km^2$ |
| ii. | Free | 528.36 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 186.78 $Mm^3$ |
| ii. | Actual mean yield last 15years | 90.63 $Mm^3$ |

**(c) Planned Utilization (Including losses)**

| | | |
|---|---|---|
| i. | Domestic water | 57 $Mm^3$ |
| ii. | Irrigation water | 155 $Mm^3$ |

**(d) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 46253 ha |
| ii. | CCA | 38671 ha |

**(e) Irrigated Area**

| | | |
|---|---|---|
| | Rabi | 27070 ha |

**(f) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 207 $Mm^3$ |
| ii. | Live | 193 $Mm^3$ |

**(g) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 14.64 cumecs |
| iii. | Length | 30.42 km |
| iv. | Distributaries/ Minor | 21 Nos. |
| v. | Length | 230.4 km |

**(h) Cropping Pattern**

| | | |
|---|---|---|
| | Design Cropping Pattern | |
| i. | Wheat | 20.8% |
| ii. | Gram | 4.8% |

iii. Mustard 74.4%

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 61.54% | 1980 |
| ii. | Barley | 1.20% | 2202 |
| iii. | Gram | 3.05% | 1084 |
| iv. | Mustard | 32.01% | 932 |
| v. | Other | 2.19% | - |

**(i) Status of WUA** 15Nos. WUA, 3DC &1PC

**(j) Status of micro-irrigation** Nil

### *5.51.3 Present Status*

The project has been rehabilitated under RWSRP in 2011 and presently the overall efficiency is 49.10% which will further improv by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining in unlined reaches.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 15WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.52 Jetpura Irrigation Project

### *5.52.1 Introduction*

Jetpura Irrigation Project has been constructed on Unli River which is a tributary of Banas River the dam and reservoir are situated near Jalan ki Jhonpria of Mandalgarh Tehsil Bhilwara District the construction of dam and canal was completed in 1957. The capacity of the reservoir was increased in 1983 by raising the height of the gates by 0.45 m. Also a diversion dam "Swaroop Ji Ka Khera" was constructed in 1992. The feeder canal of this diversion dam joins the main canal of Jetpura at 3.20 km to supplement supplies to the Jetpura command.

### *5.52.2 Important Features*

**(a) Catchment**

i. Gross 131 $km^2$

ii. Free 131 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 16.56 $Mm^3$

| (c) Command Area | Designed | Actual |
|---|---|---|
| i. GCA | 4050 ha | 4050 ha |
| ii. CCA | 3730 ha | 3730 ha |
| iii. ICA | 2120 ha | 2120 ha |
| iv. Irrigated Area | 2120 ha | N.A |

**(d) Storage Capacity**

| | |
|---|---|
| i. Gross | 25.97 $Mm^3$ |
| ii. Live | 25.55 $Mm^3$ |

**(e) Canals**

| | |
|---|---|
| i. Main Canal | One |
| ii. Discharge at head | 2.730 cumecs |
| iii. Length | 17.526 km |
| iv. Distributory/ Minor | 5 Nos. |
| v. Length | 21.28 km |

**(f) Cropping Pattern**

Designed N.A

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 78.0% | 2693 |
| ii. | Gram | 6.5% | 503 |
| iii. | Barley | 1.0% | 2192 |
| iv. | Mustard | 2.5% | 781 |
| v. | Other | 12% | - |

**(g) Status of WUA** 5 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.52.3 Present Status*

The project has been rehabilitated under RWSRP in 2011 and presently the overall efficiency is 46.57% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining in unlined reaches.
3. Construction of pipe out lets and measuring devices on canal.

4. Repair & Construction of VRB.
5. 2 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.53 Juggar Irrigation Project

### *5.53.1 Introduction*

Juggar Irrigation Project has been constructed on Juggar Nallah near Hindaun City which is a tributary of Gambhir River the dam and reservoir are situated near Hindaun City of Hindaun Tehsil in Karauli District the construction of dam and canal was completed in 1957.

### *5.53.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 227.82 $km^2$ |
| ii. | Free | 227.82 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 37.23 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 9.06 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 6264 ha | 6264 ha |
| ii. | CCA | 5927 ha | 5927 ha |
| iii. | Irrigated Area | 3334 ha | 636 ha (Last ten years) |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 39.97 $Mm^3$ |
| ii. | Live | 31.51 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 4.98 cumecs |
| iii. | Length | 18.04 km |
| iv. | Distributory/ Minor | 8 Nos. |
| v. | Length | 25.29 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 66% | 3906 |

| | | | |
|---|---|---|---|
| ii. | Gram | 3% | 950 |
| iii. | Barley | 2% | 3141 |
| iv. | Mustard | 27% | 1390 |
| v. | Other | 2% | - |

**(g) Status of WUA** 8 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.53.3 Present Status*

The project has been rehabilitated under RWSRP in year 2010. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Improvement of canal section and distribution system and providing lining in the vulnerable reaches.
3. Improvement and modification to existing CD works and VRBs, providing additional CD works whereever required along with water flow measuring devices
4. 8WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.54 Kalakh Sagar Irrigation Project

### *5.54.1 Introduction*

Kalakh Sagar Irrigation Project has been constructed on Bandi River which is a tributary of Banas River. The dam and reservoir are situated near Manoharpura of Dudu Tehsil in Jaipur District. The construction of dam and canal was completed in 1883.

### *5.54.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 586 $km^2$ |
| ii. | Free | 586 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 33.84 |
| ii. | Actual mean yield last 15 years | No water received in dam for the last 15 years |

| | **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 14569 ha | 14569 ha |
| ii. | CCA | 109615 ha | 109615 ha |
| iii. | ICA | 5480 ha | 5480 ha |
| iv. | Intensity of Irrigation | 50% | |
| v. | Irrigated Area | 5480 ha | No irrigation for the last15 years |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 16.44 $Mm^3$ |
| ii. | Live | 16.44 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | N.A |
| iii. | Length | 52 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity** No irrigation for the last 15 years

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.54.3 Present Status*

It is reported that from 1985, there has been practically no inflow in the reservoir. Therefore as far as surface water project is concerned this stands virtually abandoned. There is no other source of water from which water can be diverted to this dam for irrigation in the command hence no action for rehabilitation is needed.

## 5.55 Kalakho Irrigation Project

### *5.55.1 Introduction*

Kalakho Irrigation Project has been constructed on Kharandi River which is a tributary of Banganga River near Dausa the dam and reservoir are situated in Dausa Tehsil in Dausa District the construction of dam and canal was completed in 1953.

### *5.55.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 133.76 $km^2$ |
| ii. | Free | 133.76 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 5 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 3778 ha | 3778 ha |
| ii. | CCA | 3400 ha | 3400 ha |
| iii. | Irrigated Area | 2550 ha | 2550 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 13.28 $Mm^3$ |
| ii. | Live | 10.82 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 1.61 cumecs |
| iii. | Length | 23.17 km |
| iv. | Distributory/ Minor | 8 Nos. |
| v. | Length | 22.06 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 31% | 3475 |
| ii. | Gram | 4% | 800 |
| iii. | Barley | 30% | 2520 |
| iv. | Mustard | 32% | 1316 |
| v. | Other | 3% | - |

**(g) Status of WUA** 5 Nos. WUA & DC

**(h) Status of micro-irrigation** Nil

### *5.55.3 Present Status*

The project has been rehabilitated under RWSRP and the main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water courses d/s of outlet in 15m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 4 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.56 Kalisil Irrigation Project

### *5.56.1 Introduction*

Kalisil Irrigation Project has been constructed on Kalisil River which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Ramthora of Sapotra Tehsil in Karauli District the construction of dam and canal was completed in 1956.

### *5.56.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 331.52 $km^2$ |
| ii. | Free | 331.52 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 25.42 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 4868 ha |
| ii. | CCA | 4700 ha |
| iii. | Irrigated Area | 3740 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 41.70 $Mm^3$ |
| ii. | Live | 37.25 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 4.68 cumecs |
| iii. | Length | 15.6 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops Rabi** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 59.58% | 3475 |
| ii. | Barley | 0.44% | 2520 |
| iii. | Gram | 0.90% | 800 |
| iv. | Mustard | 38.34% | 1316 |
| v. | Others | 0.74% | - |
| | **Total** | **100%** | |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.56.3 Present Status*

The project has overall efficiency of 22.42%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one canal which off take from the dam. Existing lined section are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.
4. WUAs are not formed.
5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.57 Kharad Irrigation Project

### *5.57.1 Introduction*

Kharad Irrigation Project has been constructed on Local Nallah near Andhi Village which is a tributary of Banganga River the dam and reservoir are situated near village Andhi of Jamwaramgarh Tehsil in Jaipur District the construction of dam and canal was completed in 1877.

### *5.57.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 69.12 $km^2$ |
| ii. | Free | 69.12 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 6.48 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 5800 ha | 5800 ha |
| ii. | CCA | 4073 ha | 4073 ha |
| iii. | Irrigated Area | 1610 ha | 1610 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 9.16 $Mm^3$ |
| ii. | Live | 9.16 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.01 cumecs |
| iii. | Length | 6.95 km |
| iv. | Distributory/ Minor | 4 Nos. |
| v. | Length | 28.69 km |

**(f) Cropping Pattern**

| | |
|---|---|
| Designed | NA |

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 0.06% | 3214 |
| ii. | Gram | 33.74% | 912 |
| iii. | Barley | 2.72% | 3041 |
| iv. | Mustard | 62.28% | 1028 |
| v. | Gochani | 0.38 | - |
| vi. | Other | 0.82% | - |

**(g) Status of WUA** 6 Nos. WUA & 1DC exist

**(h) Status of micro-irrigation** Nil

### *5.57.3 Present Status*

The project has been rehabilitated under RWSRP in year 2010 and overall efficiency is 41.37% and this will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Pipe out let have been replaced to gate.
4. Repair & Construction of VRB.
5. 6WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.58 Kharda Irrigation Project

### *5.58.1 Introduction*

Kharda Irrigation Project has been constructed on Local Nallah a tributary of Luni River. The dam and reservoir are situated near Kharda in Pali Tehsil in Pali District the construction of dam and canal was completed in 1955.

### *5.58.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 370.68 $km^2$ |
| ii. | Free | 325.11 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 6.05 $Mm^3$ |

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 2692.74 ha | 2692.74 ha |

| | | | |
|---|---|---|---|
| ii. | CCA | 2605.15 ha | 2605.15 ha |
| iii. | Irrigated Area | 1563 ha | No Irrigation have been done for the last ten years |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 18.80 $Mm^3$ |
| ii. | Live | 18.80 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Length | 5.4 km |
| iii. | Distributory/ Minor | 2 Nos. |
| iv. | Length | 12.21 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 36.46% | 1980 |
| ii. | Raida | 59.72% | 932 |
| iii. | Other | 3.82% | - |

**(g) Status of WUA** 4 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.58.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 31% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water courses d/s of outlet in 15m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 4WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.59 Khari Irrigation Project

### *5.59.1 Introduction*

Khari Irrigation Project has been constructed on Khari River which is a tributary of Banas River of Banas Basin the dam and reservoir are situated near Danda Village of Asind Tehsil in Bhilwara District the construction of dam and canal was completed in 1957.

### *5.59.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 712 $km^2$ |
| ii. | Free | 518 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 55.46 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 15.51 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 10121 ha |
| ii. | CCA | 6478 ha |
| iii. | Irrigated Area | 3809 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 38.96 $Mm^3$ |
| ii. | Live | 33.30 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 5.216 cumecs & 0.80 cumecs |
| iii. | Length | 29.75 km &6.40 km |
| iv. | No Distributory/Minor/ Sub minors | 15 |
| v. | Total length of system | 76.9 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 68.24% | 3921 |
| ii. | Gram | 1.93% | 503 |
| iii. | Barley | 11.80% | 2192 |
| iv. | Oil Seeds | 16.75% | 315 |
| v. | Other | 1.28% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.59.3 Present Status*

The project has overall efficiency f 14%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.60 Kota Barrage Project

### *5.60.1 Introduction*

The Kota Barrage Project is a part of the Chambal Valley Development Project – A joint undertaking of the government of Madhya Pradesh and Rajasthan. The water of Chambal River and Hydel power generation thereto are to be shared between Madhya Pradesh and Rajasthan in equal proportion. The total water available up to barrage has been assessed as 3.2 MAF. Kota Barrage is the fourth in series Chambal Valley Project. Water released after power generation at Gandhi Sagar, Ranapratap Sagar and Jawahar Sagar dams is diverted to Kota Barrage for irrigation in both the states through canals on left and right side of the river. The work on this dam completed in 1960.

### *5.60.2 Important Features*

**(a) Command Area (Rajasthan portions)**

| | | |
|---|---|---|
| i. | Gross Command Area | 4.85 Lakh ha |
| ii. | Culturable Command Area | 2.29 Lakh ha |
| iii. | Intensity of Irrigation | 76% (21% in Kharif and 55% in Rabi) |

| **(b) Main Canal** | | **LMC** | **RMC** |
|---|---|---|---|
| i. | Discharge at head | 42.465 cumecs, | 188.47cumecs |
| ii. | Length | 2.59 km & 327 km (124 km in Rajasthan) | |
| iii. | No Branch/Disty/ Minor | 205 & 34 | |
| iv. | Length of System | 1332 km | |

**(c) Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Kharif** | | |
| i. | Paddy | 36.00% | 3539 |

| | | | |
|---|---|---|---|
| ii. | Sugarcane | 4.32% | 46110 |
| iii. | Groundnuts & Other Oil Seeds | 57.68% | 1240 |
| iv. | Maize & Soybeans | 1.50% | 1202.66 |
| v. | Others | 0.50% | - |
| | **Rabi** | | |
| i. | Wheat | 51.32% | 3417 |
| ii. | Gram | 4.00% | 951 |
| iii. | Barley | 1.24% | 2470 |
| iv. | Mustard | 32.88% | 1164 |
| v. | Coriander | 4.94% | 1118 |
| vi. | Other | 5.62% | |

**(d) Status of WUA** 159WUA'S have been formed

**(e) Status of micro-irrigation** Nil

### *5.60.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 33% which will further improve by active involvement of WUAs in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. 159WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.61 Kothari Irrigation Project

### *5.61.1 Introduction*

Kothari Irrigation Project has been constructed on Kothari River which is a tributary of Banas River of Banas Basin the dam and reservoir are situated near Nandrai Village of Mandalgarh Tehsil in Bhilwara District the construction of dam and canal was completed in 1989.

### *5.61.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 2201 $km^2$ |
| ii. | Free | 329 $km^2$ |

**(b) Water Availability**

i. Design mean yield - 26.65 $Mm^3$

ii. Actual mean yield last 14 years 14.33 $Mm^3$

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 6120 ha |
| ii. CCA | 4395 ha |
| iii. Irrigated Area | 3077 ha |

| **(d) Storage Capacity** | |
|---|---|
| i. Gross | 26.05 $Mm^3$ |
| ii. Live | 21.52 $Mm^3$ |

| **(e) Canals** | |
|---|---|
| i. Main Canal | Two |
| ii. Discharge at head | 0.83 cumecs &1.38 cumecs |
| iii. Length | 7.875 km & 14.1 km |
| iv. No Disty/Minor/ Sub minors | 5 |
| v. Total length of system | 12.5 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 73.67% | 2693 |
| ii. | Gram | 2.00% | 503 |
| iii. | Barley | 3.65% | 2192 |
| iv. | Oil Seeds | 20.29% | 1706 |
| v. | Other | 0.39% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.61.3 Present Status*

The project has overall efficiency of 26.04%. It is seen that actual overall efficiency is much below than designed due to following reasons

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require repair.

5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.62 Lassadia Irrigation Project

### *5.62.1 Introduction*

Lassadia Irrigation Project has been constructed on Dai River. Which is a tributary of Banas River the dam and reservoir are situated near Jal Ka Khera of Kekri Tehsil in Ajmer District the construction of dam and canal was completed in 1980.

### *5.62.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 2411 $km^2$ |
| ii. | Free | 148 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 12.74 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 4.42 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 2320 ha |
| ii. | CCA | 2080 ha |
| iii. | Irrigated Area | 1352 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 11.49 $Mm^3$ |
| ii. | Live | 10.65 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.015 cumecs |
| iii. | Length | 2 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 45.20% | 2471 |
| ii. | Gram | 0.21% | 410 |
| iii. | Barley | 20.21% | 2200 |
| iv. | Oil Seeds | 12.15% | 560 |
| v. | Cummins | 7.90% | 274 |

| | | | |
|---|---|---|---|
| vi. | Vegetables | 6.20 | 281 |
| vii. | Other | 8.13% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.62.3 Present Status*

The project has overall efficiency of 11%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one canal which off take from the dam. Existing lined section are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.
4. WUAs are not formed.
5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.63 Lhasi Irrigation Project

### *5.63.1 Introduction*

Lhasi Irrigation Project has been constructed on Lhasi River which is a tributary of Chambal River the dam and reservoir are situated near village Chhipabarod of Chhipabarod Tehsil in Baran District the construction of dam and canal was completed in 2012.

### *5.63.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 128.70 $km^2$ |
| ii. | Free | 128.70 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 38.91 $Mm^3$ |
| ii. | Actual mean yield last 15 years | Newly Constructed |

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 4321 ha |
| ii. | CCA | 4026 ha |
| **(d) Irrigated Area** | | **Designed** |
| i. | Kharif | 820 ha |
| ii. | Rabi | 3565 ha |
| | **Total** | **4385 ha** |

**(e) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 30.80 $Mm^3$ |
| ii. | Live | 28.30 $Mm^3$ |

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.00 cumecs |
| iii. | Length | 19.50 km |
| iv. | Distributory/ Minor | 9 Nos. |
| v. | Length | N.A |

**(g) Cropping Pattern**

Designed Cropping Pattern

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 25.36% | 3761 |
| ii. | Gram | 15.00% | 1029 |
| iii. | Maize | 5.91% | 1666 |
| iv. | Mustard | 31.27% | 1441 |
| v. | Soyabeen | 14.46% | 1140 |
| vi. | Coriander | 16.92% | 1265 |

**(h) Status of WUA** Not formed

**(i) Status of micro-irrigation** Nil

### *5.63.3 Present Status*

The project has been constructed recently and overall efficiency is 57% therefore there is no need to rehabilitate the project.

## 5.64 Madho Sagar Irrigation Project

### *5.64.1 Introduction*

Madho Sagar Irrigation Project has been constructed on Choti River which joins Banganga River of Banganga Basin. The dam and reservoir are situated near Sikarai of Dausa Tehsil in Dausa District the construction of dam and canal was completed in 1887.

### *5.64.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 75.4 $km^2$ |
| ii. | Free | 75.4 $km^2$ |

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 2.98 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 5385 ha

ii. CCA 3232 ha

iii. Irrigated Area 2382 ha

**(d) Storage Capacity**

i. Gross 22.61 $Mm^3$

ii. Live 22.50 $Mm^3$

**(e) Canals**

i. Main Canal One

ii. Discharge at head 2.70 cumecs

iii. Length 15.6 km

iv. Distributory/ Minor 9 Nos.

v. Length of system 34.45 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| 1. | Wheat | 31% | 3475 |
| 2. | Gram | 4% | 800 |
| 3. | Barley | 30% | 2520 |
| 4. | Mustard | 32% | 1316 |
| 5. | Other | 3% | - |
| | **Total** | **100%** | |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.64.3 Present Status*

The project has overall efficiency of 5.40%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one canal which off take from the dam. Existing lined section are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.
4. WUAs are not formed.

5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.65 Mahi Bajaj Sagar Project

### *5.65.1 Introduction*

Mahi Bajaj Sagar Project was constructed to impound Mahi River water for use in Rajasthan & Gujarat. It is an interstate multipurpose scheme located 16 km northeast of Banswara Town in Rajasthan. The project conduces a dam, a system of canals and two hydroelectric power stations one with 50 MW capacity near Banswara and another with 90 MW capacity near Lilvani Village, the construction of dam canals etc was completed in 1983.

### *5.65.2 Important Features*

**(a) Catchment**

i. Gross 6149 $km^2$ (1785 $km^2$ in Rajasthan, 4364 $km^2$ in Gujarat)

ii. Free 6088 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 1576.52

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 1,35000 ha |
| ii. CCA | 80,000 ha |
| iii. Intensity of irrigation | 89% |

**(d) Irrigated Area**

| | |
|---|---|
| i. Kharif | 20000 ha |
| ii. Rabi | 51200 ha |
| iii. Actual irrigation | 43200 ha (average of last 6 years) |

**(e) Storage Capacity (The available water is to be shared between Rajasthan & Gujarat in 16:40 ratio.)**

| | |
|---|---|
| i. Gross | 2180.39 $Mm^3$ |
| ii. Live | 1833.72 $Mm^3$ |

**(f) Canals**

| **Main Canal** | **LMC** | **RMC** | **Bhungra Canal** |
|---|---|---|---|
| i. Discharge at head | 30.00 cumecs | 62.53 cumecs | 3.197 cumecs |
| ii. Length | 36.12 km | 71.72 km | 39.80 km |
| iii. Distributory/ Minor | 19 Nos. | | |
| iv. Length | 1887.67 km | | |

**(g) Cropping Pattern**

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| | **Kharif** | | |
| i. | Maize | 12.00% | 971 |
| ii. | Paddy | 16.00% | 609 |
| iii. | Cotton | 36.00% | 899 |
| iv. | Kharif, Pulses, Sugarcane & Others | 36.00% | - |
| | **Rabi** | | |
| i. | Wheat | 90.28% | 3761 |
| ii. | Gram | 2.97% | 1207 |
| iii. | Barley | 0.70% | 1426 |
| iv. | Mustard | 0.10% | 719 |
| v. | Maize | 4.55% | 971 |
| vi. | Rabi Fodder | 1.02% | - |
| vii. | Others | 0.37 | - |

**(h) Status of WUA** Not formed

**(i) Status of micro-irrigation** Nil

### *5.65.3 Present Status*

The project has overall efficiency of 33.50%. It is seen that actual irrigation is much below than designed due to following reasons.

1. Non-development of full command.
2. The strata are loose soft rock. It slides dumps in canal bed in some reaches in LMC Therefore resectioning and cut of cover in venerable reaches are required.
3. Canals are damaged and required repairing.
4. Numbers of siphons/aqueducts /VRB are damaged and require repair.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.66 Mandal Irrigation Project

### *5.66.1 Introduction*

The Mandal Dam has been constructed across a Local Nallah of Kothari Sub-basin of Banas Basin. The nearby village is Mandal of Tehsil Mandal of Bhilwara District the construction of dam and canal was completed in 1954.

### *5.66.2 Important Features*

**(a) Catchment**

i. Gross 108 $km^2$

ii. Free 99 $km^2$

**(b) Water Availability**

i. Design mean yield - 6.23 $Mm^3$

ii. Actual mean yield last 15 years 4.68 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 4773 ha

ii. CCA 3818 ha

**(d) Storage Capacity**

i. Gross 13.8 $Mm^3$

ii. Live 11.87 $Mm^3$

**(e) Canals**

i. Main Canal at head One

ii. Length 25.95 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 73.67% | 2693 |
| ii. | Gram | 2.00% | 503 |
| iii. | Barley | 3.65% | 2192 |
| iv. | Oil Seeds | 20.29% | 315 |
| v. | Other | 0.39% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.66.3 Present Status*

The project has overall efficiency of 8%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one main canal which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.67 Mansarovar Irrigation Project

### *5.67.1 Introduction*

Mansarovar Irrigation Project has been constructed on Kundeli Nallah near Jaitpura Village which is a tributary of Chambal River the dam and reservoir are situated near village Jaitpurai of Khandar Tehsil in Sawai Madhopur District the construction of dam and canal was completed in 1957.

### *5.67.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 90.65 $km^2$ |
| ii. | Free | 90.65 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 9.90 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 4041 ha | 5800 ha |
| ii. | CCA | 3167.61 ha | 4073 ha |
| iii. | Irrigated Area | 3167 ha | 2141 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 15.3 $Mm^3$ |
| ii. | Live | 13.92 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.39 cumecs |
| iii. | Length | 13.44 km |
| iv. | Distributory/ Minor | 6 Nos. |
| v. | Length | 15.36 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 62.64% | 3484 |
| ii. | Gram | 1.03% | 1044 |
| iii. | Barley | 0.18% | 1975 |
| iv. | Mustard | 22.54% | 1109 |
| v. | Vegetable | 13.17% | 374 |

| | | | |
|---|---|---|---|
| vi. | Other | 0.44% | - |

**(g) Status of WUA** 3 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.67.3 Present Status*

The project has been rehabilitated under RWSRP in year 2010 and overall efficiency is 49.00% and this will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Improvement of canal section and distribution system and providing lining in the vulnerable reaches.
3. Improvement and modification to existing CD works and VRBs, providing additional CD works whereever required along with water flow measuring devices.
4. 3WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.68 Mashi Irrigation Project

### *5.68.1 Introduction*

Mashi Irrigation Project has been constructed on Mashi River near Jodhpuria which is a tributary of Banas River the dam and reservoir are situated near Jodhpuria of Niwai Tehsil in Tonk District the construction of dam and canal was completed in 1960.

### *5.68.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 5776 $km^2$ |
| ii. | Free | 1652 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 87 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 29.43 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 8177 ha | 8177 ha |
| ii. | CCA | 6985 ha | 6985 ha |
| iii. | Irrigated Area | 4890 ha | 3764 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 48.13 $Mm^3$ |
| ii. | Live | 35.11 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 5.29 cumecs |
| iii. | Length | 42.18 km |
| iv. | Distributory/ Minor | 9 Nos. |
| v. | Length | 28.65 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 27.9% | 2673 |
| ii. | Gram | 2.6% | 502 |
| iii. | Barley | 6.0% | 1978 |
| iv. | Oil Seeds | 58.3% | 546 |
| v. | Pulses | 0.1% | 166 |
| vi. | Other | 5.3% | - |

**(g) Status of WUA** 4 Nos. WUA &1DC exist

**(h) Status of micro-irrigation** Nil

### *5.68.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 43.66% which will further improve by active involvement of WUAs in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of ulined canal into lined canal.
3. Repair & Construction of VRB.
4. 4WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.69 Mataji Ka Khera Irrigation Project

### *5.69.1 Introduction*

Mataji Ka Khera Irrigation Project has been constructed on Local Nallah which is a tributary of Banas River of Banas Basin the dam and reservoir are situated near Mataji Ka Khera Village of Railmagra Tehsil in Rajsamand District the construction of dam and canal was completed in 1958.

### *5.69.2 Important Features*

**(a) Catchment**

i. Gross 14.16 $km^2$

ii. Free 14.16 $km^2$

**(b) Water Availability**

i. Design mean yield - 0.80 $Mm^3$ & 11.00 $Mm^3$ Diversion from Nandsamand.

ii. Actual mean yield last 15 years 1.05 $Mm^3$

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 3644 ha |
| ii. CCA | 3057 ha |
| iii. Irrigated Area | 2140 ha |

**(d) Storage Capacity**

| | |
|---|---|
| i. Gross | 26.05 $Mm^3$ |
| ii. Live | 21.52 $Mm^3$ |

**(e) Canals**

| | |
|---|---|
| i. Main Canal | Two |
| ii. Discharge at head | 0.484 cumecs & 0.7049 cumecs |
| iii. Length | 13.680 km & 10.500 km |
| iv. No Disty/Minor/ Sub minors | 5 |
| v. Total length of system | 12.5 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 80.86% | 2602 |
| ii. | Gram | 0.40% | 780 |
| iii. | Barley | 13.12% | 1985 |
| iv. | Oil Seeds | 2.35% | 719 |
| v. | Other | 3.27% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.69.3 Present Status*

The project has overall efficiency of 7.45%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Mataji Ka Khera existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require the repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.70 Matrikundia Pick-up Weir

### *5.70.1 Introduction*

Matrikundia Pick-up Weir has been constructed on Banas River near village Matrikundia in Railmagra Tehsil completed in 1982. It feeds water to Meja Dam through a 58 km long Meja Feeder canal having a discharge capacity of 8.5 $m^3$/sec. Matrikundia Dam serves also as a source of water to the zinc mines of Hindustan Zinc Company Ltd. (HZL). There is no direct irrigation from this Pick-up Weir.

### *5.70.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 3415 $km^2$ |
| ii. | Free | 943 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A. |
| ii. | Actual mean yield last 15 years | N.A. |

**(c) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 50.65 $Mm^3$ |
| ii. | Live | 49.97 $Mm^3$ |

**(d) Canals**

| | | |
|---|---|---|
| i. | Diversion Canal | One (to Meja Dam) |
| ii. | Discharge at head | 8.50 cumecs |
| iii. | Length | 58.20 km |

## 5.71 Meja Irrigation Project

### *5.71.1 Introduction*

Meja Irrigation Project has been constructed on Kothari River which is a tributary of Banas River of Banas Basin the dam and reservoir are situated near Meja Village of Bhilwara Tehsil in Bhilwara District the construction of dam and canal was completed in 1957.

### *5.71.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1651 $km^2$ |
| ii. | Free | 1048 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 77.67 $Mm^3$ |
| ii. | Actual mean yield last 14 years | 1.77 $Mm^3$ & 19.81 $Mm^3$ diverted from Matrikundia |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 25910 ha |
| ii. | CCA | 20714 ha |
| iii. | Irrigated Area | 14500 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 84.00 $Mm^3$ |
| ii. | Live | 83.55 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 7.84 cumecs & 3.65 cumecs |
| iii. | Length | 25.95 km & 36.40 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 73.67% | 2693 |
| ii. | Gram | 2.00% | 503 |
| iii. | Barley | 3.65% | 2192 |
| iv. | Oil Seeds | 20.29% | 1706 |
| v. | Other | 0.39% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.71.3 Present Status*

The project has overall efficiency of 15.65%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.

2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require the repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.72 Mora Sagar Irrigation Project

### *5.72.1 Introduction*

Mora Sagar Irrigation Project has been constructed on Local Nallah which is a tributary of Banas River the dam and reservoir are situated near Bamanwas of Bamanwas Tehsil in Sawai Madhopur District the construction of dam and canal was completed in 1887.

### *5.72.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 138 $km^2$ |
| ii. | Free | 138 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 5.09 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 4910 ha | 4910 ha |
| ii. | CCA | 7374 ha | 7374 ha |
| iii. | Irrigated Area | 7374 ha | 2483 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 12.92 $Mm^3$ |
| ii. | Live | 12.86 $Mm^3$ |

**(e) Canals**

| | **Main Canal** | **RMC** | **LMC** | **Third Sluice Canal** |
|---|---|---|---|---|
| i. | Discharge at head | 2.05 cumecs | 0.56 cumecs | 0.509 cumecs |
| ii. | Length | 19.5 km | 9.25 km | 3.16 km |
| iii. | Distributory/ Minor | 29 Nos. | | |
| iv. | Length | 84.70 km | | |

**(f) Cropping Pattern**

Designed N.A

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 43.74% | 3484 |
| ii. | Gram | 53.53% | 1044 |
| iii. | Barley | 1.76% | 1975 |
| iv. | Mustard | 0.11% | 1109 |
| v. | Other | 0.86% | - |

**(g) Status of WUA** 6 Nos. WUA, 2DC & 1PC

**(h) Status of micro-irrigation** Nil

### *5.72.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 47.78% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches.
3. Construction of pipe outlets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 6 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.73 Morel Irrigation Project

### *5.73.1 Introduction*

Morel Irrigation Project has been constructed on Morel River near village Bagri which is a tributary of Banas River the dam and reservoir are situated near Bagri of Lalsot Tehsil in Dausa District the construction of dam and canal was completed in 1952 and dam was reconstructed in 1984.

### *5.73.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 3346 $km^2$ |
| ii. | Free | 2227 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 76.45 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 27.22 $Mm^3$ |

| | | | |
|---|---|---|---|
| **(c) Command Area** | | **Designed** | **Actual** |
| i. | GCA | 21306 ha | 21306 ha |
| ii. | CCA | 19393 ha | 19393 ha |
| iii. | Irrigated Area | 11963 ha | 4373 ha |
| **(d) Storage Capacity** | | | |
| i. | Gross | 76.65 $Mm^3$ | |
| ii. | Live | 70.69 $Mm^3$ | |
| **(e) Canals** | | | |
| i. | Main Canal | Two | |
| ii. | Discharge at head | 13.31 cumecs & 4.98 cumecs | |
| iii. | Length | 28.60 km & 31.46 km | |
| iv. | Distributaries/ Minor | 25 Nos. | |
| v. | Length | 79.57 km | |
| **(f) Cropping Pattern** | | | |
| | Designed | NA | |

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 17.0% | 3475 |
| ii. | Gram | 8.0% | 800 |
| iii. | Barley | 1.8% | 2520 |
| iv. | Mustard | 72.9% | 1316 |
| v. | Other | 0.3% | - |

**(g) Status of WUA** 17 Nos. WUA 2 DC & 1PC exist

**(h) Status of micro-irrigation** Nil

### *5.73.3 Present Status*

The project has been rehabilitated under RWSRP in year 2011 and the present overall efficiency is 42% and this will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Remolding of existing waste weir.
2. Providing additional spillway (274.77 m).
3. Re-alignment of Morel Dan in the length of 1235 m.
4. Raising of bund in a length of 305 m.
5. Raising of non-overflow portion in the length of 36.58 m.
6. Protection of bund and marginal bund.
7. Providing new rock toe filter.

8. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
9. Improvement of canal section and distribution system and providing lining in the vulnerable reaches.
10. Improvement and modification to existing CD works and VRBs, providing additional CD works whereever required along with water flow measuring devices.
11. 17 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.74 Moti Sagar Irrigation Project

### *5.74.1 Introduction*

Moti Sagar Irrigation Project has been constructed on Dhuan Ka Nala near Chhan which joins Banas River near village Bharot. The dam and reservoir are situated near Chhan of Deoli Tehsil in Tonk District the construction of dam and canal was completed in 1955.

### *5.74.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 109 $km^2$ |
| ii. | Free | 109 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 14.22 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 7.88 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 2318 ha | 2318 ha |
| ii. | CCA | 2157 ha | 2157 ha |
| iii. | Irrigated Area | 1780 ha | 1780 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 12.87 $Mm^3$ |
| ii. | Live | 12.42 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal at head | One |
| ii. | Length of canal system | 28.97 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern % of CCA | Productivity (Kg/ha) |
|---|---|---|---|
| | **Kharif** | | |
| i. | Jawar | 12% | 454 |
| ii. | Ground Nuts | 4% | 558 |
| iii. | Maize | 8% | 258 |
| iv. | Soyabean | 4% | 1165 |
| | **Rabi** | | |
| i. | Wheat | 19% | 2673 |
| ii. | Gram | 2% | 1978 |
| iii. | Barley | 7% | 502 |
| iv. | Mustard | 3% | 1125 |
| v. | Other | 13% | 769 |

**(g) Status of WUA** 1 No. WUA

**(h) Status of micro-irrigation** Nil

### *5.74.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 48.75% which will further improve by active involvement of WUAs in operational management and the Dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. 1WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.75 Murlia Irrigation Project

### *5.75.1 Introduction*

Murlia irrigation project has been construction on local Drain which joins Gambhiri River, Tributary of Banas River. The dam and reservoir are situated near village Murlia of Nimbahera Tehsil in Chittaurgarh district Construction of dam and Canal was completed in 1967.

### *5.75.2 Important Features*

**(a) Catchment**

i. Gross 111.4 $km^2$

ii. Free 111.4 $km^2$

**(b) Water Availability**

i. Design mean yield - 12.00 $Mm^3$

ii. Actual mean yield last 15 years 3.73 $Mm^3$

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 1497 ha | 1497 ha |
| ii. CCA | 1323 ha | 1323 ha |
| iii. Irrigated Area | 957 ha | 957 ha |

**(d) Storage Capacity**

i. Gross 9.62 $Mm^3$

ii. Live 8.47 $Mm^3$

**(e) Canals**

i. Main Canal Two

ii. Length of canal system 18.45 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 75.44% | 3295 |
| ii. | Barley | 4.17% | 2886 |
| iii. | Gram | 2.78% | 946 |
| iv. | Mustard | 9.68% | 1223 |
| v. | Other (Vegetables, Rijika & Pulses) | 7.93% | - |

**(g) Status of WUA** Nil

**(h) Status of micro-irrigation** Nil

### *5.75.3 Present Status*

The actual overall efficiency of the project is 20.31% which is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require repair.
5. WUAs are not formed.

6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.76 Nahar Sagar Irrigation Project

### *5.76.1 Introduction*

Nahar Sagar Irrigation Project has been constructed on Local River which is a tributary of Khari River of Banas Basin. The dam and reservoir are situated near Sardarpura of Shahpura Tehsil in Bhilwara District. The construction of dam and canal was completed in 1909.

### *5.76.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 538.7 $km^2$ |
| ii. | Free | 343.7 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 26.86 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 4978 ha |
| ii. | CCA | 4775 ha |
| iii. | Intensity of Irrigation | 73.4% |
| iv. | Irrigated Area | 3505 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 24.69 $Mm^3$ |
| ii. | Live | 24.5 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Length | 9.25 km & 19.50 km |
| iii. | Distributory/ Minor | 11 Nos. |
| iv. | Length | 21.59 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 75.44% | 3921 |
| ii. | Barley | 4.17% | 2192 |
| iii. | Gram | 2.78% | 503 |

| | | | |
|---|---|---|---|
| iv. | Mustard | 9.68% | 781 |
| v. | Other (Vegetables, Rijika & Pulses) | 7.93% | - |

**(g) Status of WUA** 15 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.76.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 48.57% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches.
3. Construction of pipe outlets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 15 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.77 Nand Samand Irrigation Project

### *5.77.1 Introduction*

Nand Samand Irrigation Project has been constructed on Banas River near village Nichali Oden the dam and reservoir are situated near Nichali Oden of Nathdwara Tehsil in Rajsamand District. The construction of dam and canal was completed in 1955. The dam height was raised in year 1968 by 2 feet to increasing its capacity by 2.83 $Mm^{-3}$. It is planned to divert 32 $Mm^3$ water during monsoon to Rajsamand Tank and other minor tanks through Khari Feeder.

### *5.77.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 829 $km^2$ |
| ii. | Free | 622.14 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 88.80 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 10.73 $Mm^3$ |

| | | | |
|---|---|---|---|
| **(c)** | **Command Area** | **Designed** | **Actual** |
| i. | GCA | 8702 ha | 8702 ha |
| ii. | CCA | 7885 ha | 7885 ha |
| iii. | Irrigated Area | 3255 ha (800 ha in Kharif & 2304 ha in Rabi) | 3360 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 21.225 $Mm^3$ |
| ii. | Live | 20.631 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 4.816 cumecs & 14 cumecs |
| iii. | Length | 29.4 km & 2.25 km |
| iv. | Distributory/ Minor | 16 Nos. |
| v. | Length | 46.5 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 80.86% | 2673 |
| ii. | Gram | 0.40% | 502 |
| iii. | Barley | 13.12% | 1978 |
| iv. | Oil Seeds | 2.35% | 546 |
| v. | Other | 3.27% | - |

**(g) Status of WUA** 7 WUA & 1DC exist

**(h) Status of micro-irrigation** Nil

### *5.77.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 42.00% which will further improve by active involvement of WUAs in operational management and the dam & main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Repair & Construction of VRB.
4. 4 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.78 Narain Sagar Irrigation Project

### *5.78.1 Introduction*

Narain Sagar Irrigation Project has been constructed on Local Drain having small catchment. This dam is mainly fed with water of Khari River Which is a tributary of Banas River the dam and reservoir are situated near Jalia II of Beawer Tehsil in Ajmer District the construction of dam and canal was completed in 1967.

### *5.78.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 840.89 $km^2$ |
| ii. | Free | 148 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 53.66 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 1.67 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 4351 ha |
| ii. | CCA | 4087 ha |
| iii. | Irrigated Area | 2854 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 19.95 $Mm^3$ |
| ii. | Live | 19.82 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 2.85 cumecs & 1.436 cumecs |
| iii. | Length | 7.345 km & 8.229 km |
| iv. | Distributory/ Minor | 4 Nos. |
| v. | Length | 18.957 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 45.20% | 2471 |
| ii. | Gram | 0.21% | 410 |
| iii. | Barley | 20.21% | 2200 |
| iv. | Oil Seeds | 12.15% | 560 |
| v. | Cummins | 7.90% | 274 |

| | | | |
|---|---|---|---|
| vi. | Vegetables | 6.20 | 281 |
| vii. | Other | 8.13% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.78.3 Present Status*

The project has overall efficiency of 5.25%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one canal which off take from the dam. Existing lined section are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.
4. WUA are not formed.
5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.79 Narmada Canal Project

### *5.79.1 Introduction*

The Narmada Development Project is a multipurpose project planned to harness the waters of the River Narmada for development of irrigation and generation of hydroelectric power in the Western India. The allocation of utilizable water of this river among the four claimant states was decided under an award by Narmada Water Dispute Tribunal (NWDT) in 1969 as under:

| | | |
|---|---|---|
| Madhya Pradesh | 22.51 $Bm^3$ | 18.25 MAF |
| Gujarat | 11.10 $Bm^3$ | 09.00 MAF |
| Rajasthan | 00.616 $Bm^3$ | 00.50 MAF |
| Maharashtra | 00.308 $Bm^3$ | 00.25 MAF |

As per decision of the tribunal the excesses or shortages in the utilizable water shall be shared between the party states in the ratio of 73 by MP, 36 by Gujarat 1 by Maharashtra and 2 by Rajasthan. Rajasthan is supposed to get 616.74 $Mm^3$ of water at the Main Canal head out of which 131.25 $Mm^3$/yr has been reserved for Drinking water to faciliting the population of about 4.588 million in 1336 villages (697 villages of Jalore district and 639 villages of Barmer district) and 3 towns namely Jalore, Sachore and Bhinmal situated around the irrigation canal. To utilize its share of the Narmada water in the arid and semi-arid area of Jalore and Barmer Districts, the Narmada Project has been designed as per details given below. The on-farm irrigation in this project is 100% by pressurized irrigation (sprinkler system).

### *5.79.2 Important Features*

**(a) Command Area**

i. Gross Command Area 2.86 Lakh ha

| | | |
|---|---|---|
| ii. | Culturable Command Area | 2.46 Lakh ha (0.30 Lakh ha Ned area through flow, 0.96lakh ha Normal flow area through flow &1.20 Lakh ha through lift) |

**(b) Intensity of Irrigation**

1. **Flow**

| | | |
|---|---|---|
| i. | Ned area | 15% (Kharif) 25% (Rabi) Total 40% |
| ii. | Flow irrigated area | 20% (Kharif) 50% (Rabi) Total 70% |
| iii. | Lift irrigated area | 20% (Kharif) 40% (Rabi) Total 60% |

**(c) Main Canal**

| | | |
|---|---|---|
| i. | Discharge at head | 74.55 cumecs, (At Gujarat-Rajasthan border at km 458.318) |
| ii. | Length | 74 km |
| iii. | Branch/Distributaries/ Minor | 260 Nos. |
| iv. | Length of system | 1718 km |

**(d) Designed Cropping Pattern**

| | | |
|---|---|---|
| i. | Wheat | 44% |
| ii. | Gram | 9% |
| iii. | Barley | 4% |
| iv. | Mustard | 18% |
| v. | Cumin | 24% |
| vi. | Other | 1% |
| | **Total** | **100%** |

**(e) Status of WUA** Not formed

**(f) Status of micro-irrigation** 100%

### *5.79.3 Present Status*

The Narmada project is ongoing project. Therefore command area is not fully open so this project has not been considered for rehabilitation.

## 5.80 Ora Irrigation Project

### *5.80.1 Introduction*

Ora Irrigation Project has been constructed on Khari River which is a tributary of Luni River. The dam and reservoir are situated near Sirohi in Sheoganj Tehsil in Sirohi District the construction of dam and canal was completed in 1957.

### *5.80.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 235.52 $km^2$ |
| ii. | Free | 92.00 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 7.93 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 5269.44 ha | 5269 ha |
| ii. | CCA | 4616 ha | 4616 ha |
| iii. | ICA | 3227 ha | 3227 ha |
| iv. | Intensity of Irrigation | 75% | |
| v. | Irrigated Area | 2420 ha | 2471 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 22.64 $Mm^3$ |
| ii. | Live | 22.27 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 3.06 cumecs |
| iii. | Length | 15.31 km |
| iv. | Distributory/ Minor | 6 Nos. |
| v. | Length | 21.66 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 7% | 2449 |
| ii. | Jeera | 2% | 287 |
| iii. | Arandi | 9% | 27 |
| iv. | Mustard | 80% | 900 |
| v. | Other (Isabgol, Barley, Gram & Groundnuts) | 2% | - |

**(g) Status of WUA** 6 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.80.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 49.65% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water courses d/s of outlet in 15m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 6WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

   As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.81 Orai Irrigation Project

### *5.81.1 Introduction*

Orai Irrigation Project has been constructed on Orai River which is a tributary of Banas River. The dam and reservoir are situated near Gopalpura of Begun Tehsil in Chittaurgarh District. The construction of dam and canal was completed in 1975.

### *5.81.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 220.32 $km^2$ |
| ii. | Free | 220.32 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | 26.86 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 12705 ha | 12705 ha |
| ii. | CCA | 9260 ha | 9260 ha |
| iii. | ICA | 4630 ha | 4630 ha |
| iv. | Intensity of Irrigation | 50% | |
| v. | Irrigated Area | 4630 ha | 4002 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 35.287 $Mm^3$ |
| ii. | Live | 32.797 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 4.42 cumecs |
| iii. | Length | 31.50 km |
| iv. | Distributory/ Minor | 23 Nos. |

v. Length 66.30 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 75.44% | 3295 |
| ii. | Barley | 4.17% | 2886 |
| iii. | Gram | 2.78% | 946 |
| iv. | Mustard | 9.68% | 1223 |
| v. | Other (Vegetables, Rijeka & Pulses) | 7.93% | - |

**(g) Status of WUA** 15 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.81.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 36% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Remolding of existing waste weir.
2. Raising of bund.
3. Raising of non-overflow portion.
4. Providing new rock toe filter.
5. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
6. New lining in Vulnerable Reaches.
7. Construction of pipe outlets and measuring devices on canal.
8. Repair & Construction of VRB.
9. 15WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.82 Panchana Irrigation Project

### *5.82.1 Introduction*

Panchana Irrigation Project has been constructed on Panchana River near village Kashirampura which is a tributary of Gambhir River the dam and reservoir are situated near Kashirampura of Karauli Tehsil in Karauli District the construction of dam and canal was completed in 2006.

### *5.82.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 621.60 $km^2$ |
| ii. | Free | 62 60 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 83.25 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 24.34 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 11172 ha | 11172 ha |
| ii. | CCA | 9985 ha | 9985 ha |

**(d) Irrigated Area**

| | | |
|---|---|---|
| i. | Kharif | 4921 ha |
| ii. | Rabi | 8494 ha |

**(e) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 59.45 $Mm^3$ |
| ii. | Live | 52.65 $Mm^3$ |

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 7.08 cumecs |
| iii. | Length | 11.57 km |
| iv. | Distributaries/ Minor | 24 Nos. |
| v. | Length | 275 km |

**(g) Cropping Pattern**

**Designed & Present Cropping Pattern**

| S. No. | Crop | Total area (ha) Irrigated | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|---|
| **Kharif** | | | | |
| i. | Jawar | 650.00 | 13.21% | 539 |
| ii. | Bajra | 370.00 | 7.52% | 1859 |
| iii. | Maize | 28.65 | 0.58% | 1046 |
| iv. | Pulses | 1623.00 | 32.98% | 704 |
| v. | Oil Seed | 1800.00 | 36.57% | 1681 |
| vi. | Til | 450.00 | 9.14% | 596 |
| **Kharif Total** | | **4921.65** | **100%** | |
| **Rabi** | | | | |
| i. | Wheat | 2383.46 | 28.06% | 3906 |
| ii. | Barley | 579.04 | 6.82% | 3041 |
| iii. | Gram | 2635.82 | 31.03% | 950 |
| iv. | Coriander | 650.00 | 7.65% | 1187 |

| S. No. | Crop | Total area (ha) Irrigated | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|---|
| v. | Mustard | 2246.00 | 26.44% | 1390 |
| **Rabi Total** | | **8494.32** | **100%** | |
| **Total** | | **13416** | | |

**(h) Status of WUA** Not formed

**(i) Status of micro-irrigation** Nil

### *5.82.3 Present Status*

The project has been constructed recently and overall efficiency is 57% therefore there is no need to rehabilitate the project.

## 5.83 Parbati Irrigation Project

### *5.83.1 Introduction*

Parbati Project has been constructed on Parbati River which is a tributary of Gambhir River near village Angai. The dam and reservoir are situated in Baseri Tehsil in Dhaulpur District. The construction of dam and canal was completed in 1963.

### *5.83.2 Important Features*

**(a) Catchment**

i. Gross 786 $km^2$

ii. Free 786 $km^2$

**(b) Water Availability**

i. Design mean yield - 84 $Mm^3$

ii. Actual mean yield last 15years 90.63 $Mm^3$

**(c) Planned Utilization ( Including Losses)**

i. Domestic water 5.56 $Mm^3$

ii. Irrigation water 61.52 $Mm^3$

**(d) Command Area** **Designed**

i. GCA 32376 ha

ii. CCA 24667 ha

iii. ICA 12334 ha

**(e) Irrigated Area**

i. Rabi 12334 ha

**(f) Storage Capacity**

i. Gross 115.236 $Mm^3$

ii. Live 102.893 $Mm^3$

**(g) Canals**

i. Main Canal One

| | | |
|---|---|---|
| ii. | Discharge at head | 12.22 cumecs |
| iii. | Length | 54 km |
| iv. | Distributaries/ Minor | 28 Nos. |
| v. | Length | 224 km |

**(h) Cropping Pattern**

Design Cropping Pattern NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 61.8% | 3911 |
| ii. | Gram | 0.1% | 1452 |
| iii. | Mustard | 36.5% | 1446 |
| iv. | Others | 1.6% | - |

**(i) Status of WUA** 13 Nos. WUA, 3DC & 1PC

**(j) Status of micro-irrigation** Nil

### *5.83.3 Present Status*

The project has been rehabilitated under RWSRP in 2011 and presently the overall efficiency is 46% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining in unlined reaches.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 13WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.84 Parwan Lift Irrigation Project

### *5.84.1 Introduction*

Parwan Lift Scheme is being constructed on Parwan River, a tributary of Kalisindh River in Chambal Basin. The nearly village is Tulsan of Baran Tehsil in Baran District. The Parwan River originates in Madhya Pradesh and joins Kalisindh in Rajasthan near Paliatha Village. A pick up weir on the river 8 km downstream of the pumping station has being constructed to act as balancing reservoir to meet shortage of the irrigation demand when the flows in the river fall short of requirement. The project has been completed in 2001.

### *5.84.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 9557 $km^2$ (6242 $km^2$ in M.P.) |
| ii. | Free | 9175 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 37.49 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 15.86 $Mm^3$ |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 10620 ha |
| ii. | CCA | 9531 ha |
| iii. | Irrigated Area | 9135 ha (53.87% in Rabi & 41.96% in Kharif) |

**(d) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 6.13 cumecs & 0.565 cumecs |
| iii. | Length | 16.67 km & 1.5 km |

**(e) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 27.80% | 3761 |
| ii. | coriander | 9.33% | 1265 |
| iii. | Mustard | 60.50% | 1441 |
| iv. | Rabi pulses(gram) | 0.70% | 1029 |
| v. | Others | 2.37% | - |
| | **Total** | **100%** | |

**(f) Status of WUA** Not formed

**(g) Status of micro-irrigation** Nil

### *5.84.3 Present Status*

The project has overall efficiency of 36%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two canals which off take from the dam. Existing lined section are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.

4. WUAs are not formed.
5. Warabandi system is not enforced.

Parwan Lift command has been linked to the canals of newly proposed Parwan Project therefore the project has not been considered for rehabilitation.

## 5.85 Parwan Pickup Weir Irrigation Project

### *5.85.1 Introduction*

The Parwan Irrigation Project is based on a pickup weir constructed across Parwan River, a tributary of Kalisindh River in Chambal Basin. The pickup weir is situated near Shergarh Village of Atru Tehsil of Baran District. The irrigation from the pickup weir has been planned on run off the river basis and there is no effective storage created to support the irrigation.

### *5.85.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 8412.6 $km^2$ |
| ii. | Free | 7638.6 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 1694 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 7550 ha |
| ii. | CCA | 7464 ha |
| iii. | Irrigated Area | 7016 ha (54% in Rabi & 40.0% in Kharif) |

**(d) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 6.10 cumecs |
| iii. | Length | 17 km |

**(e) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 27.80% | 3761 |
| ii. | Coriander | 9.33% | 1265 |
| iii. | Mustard | 60.50% | 1441 |
| iv. | Rabi Pulses | 0.70% | 1029 |
| v. | Others | 2.37% | - |
| | **Total** | **100%** | |

| | | | |
|---|---|---|---|
| | **Kharif** | | |
| i. | Soyabean | 85.00% | 1140 |
| ii. | Jowar | 3.49% | 1642 |
| iii. | Groundnut | 3.26% | 956 |
| iv. | Paddy | 6.53% | 3342 |
| v. | Others | 1.72% | - |
| | **Total** | **100%** | |

**(f) Status of WUA** Not formed

**(g) Status of micro-irrigation** Nil

### *5.85.3 Present Status*

The project has overall efficiency of 14%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one canal which off take from the weir. Existing lined section are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require the repair.
4. WUAs are not formed.
5. Warabandi system is not enforced.

Parwan Pickup Weir command has been linked to the canals of newly proposed Parwan Project therefore the project has not been considered for rehabilitation.

## 5.86 Parwati Pickup Weir Project

### *5.86.1 Introduction*

Parwati Pickup Weir Project has been constructed on Parwati which is a tributary of Chambal River. The weir is situated near Kishanpura of Anta Tehsil in Baran District. This is a runoff river scheme, without any effective storage. The canal takes off from the pickup weir on the left flank of river.

### *5.86.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 10205 $km^2$ |
| ii. | Free | 1404 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 47.44 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 15.86 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 12990 ha |

ii. CCA 12550 ha

iii. Irrigated Area 7530 ha

**(d) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops Rabi | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 27.80% | 3761 |
| ii. | Coriander | 9.33% | 1265 |
| iii. | Mustard | 60.50% | 1441 |
| iv. | Rabi Pulses | 0.70% | 1029 |
| v. | Others | 2.37% | - |
| | **Total** | **100%** | |

**(e) Status of WUA** Not formed

**(f) Status of micro-irrigation** Nil

### *5.86.3 Present Status*

The project has overall efficiency of 20%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of one main canal which off take from the weir. Existing lined section are damaged and mostly reaches are unlined and requires resectioning & lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and requires repair.
4. WUAs are not formed.
5. Warabandi system is not enforced.

Parwati Pickup Weir's command has been linked to the canals of newly proposed Parwan Project therefore the project has not been considered for rehabilitation.

## 5.87 Phool Sagar Jalia Irrigation Project

### *5.87.1 Introduction*

Phool Sagar Jalia Irrigation Project has been constructed on Local River which is a tributary of Luni River. The dam and reservoir are situated near Jalia of Beawar Tehsil in Ajmer District. The construction of dam and canal was completed in 1911.

### *5.87.2 Important Features*

**(a) Catchment**

i. Gross 117.32 $km^2$

ii. Free 10.50 $km^2$

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 1.62 $Mm^3$ |
| ii. | Actual mean yield last 15 years | No adequate water received in dam for the last 15 years |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 2936 ha | 2936 ha |
| ii. | CCA | 2350 ha | 2350 ha |
| iii. | ICA | 1354 ha | 1354 ha |
| iv. | Irrigated Area | 1354ha | No irrigation for the last 15 years |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 9.77 $Mm^3$ |
| ii. | Live | 9.48 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | N.A |
| iii. | Length | 4.185 km & 3.363 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity** No irrigation for the last 15 years

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.87.3 Present Status*

It is reported that from the last 15 years, there has been practically no inflow in the reservoir. Therefore as far as surface water project is concerned this stands virtually abandoned. There is no other source of water from which water can be diverted to this dam for irrigation in the command hence no action for rehabilitation is needed.

## 5.88 Piplad Irrigation Project

### *5.88.1 Introduction*

Piplad Irrigation Project has been constructed on Piplad River which is a tributary of Chambal River the dam and reservoir are situated near village Chhipabarod of Panchpahar Tehsil in Jhalawar District the construction of dam and canal was completed in 2009.

### *5.88.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 145 $km^2$ (110 km in Rajasthan) |
| ii. | Free | 145 $km^2$ (110 km in Rajasthan) |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 23.078 $Mm^3$ |
| ii. | Actual mean yield last 15 years | Newly Constructed |

| | | |
|---|---|---|
| **(c) Command Area** | **Designed** | |
| i. | GCA | 5860 ha |
| ii. | CCA | 4688 ha |

**(d) Irrigated Area**

| | | |
|---|---|---|
| i. | Kharif (Cropping intensity 75.70%] | 2113 ha |
| ii. | Rabi (Cropping intensity 59.54%] | 2687 ha |
| | **Total** | **4800 ha** |

| | | |
|---|---|---|
| **(e) Storage Capacity** | | |
| i. | Gross | 24.14 $Mm^3$ |
| ii. | Live | 21.50 $Mm^3$ |

**(f) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 0.702 cumecs & 2.141 cumecs |
| iii. | Length | 5.40 km & 12.30 km |
| iv. | Distributory/ Minor | N.A |
| v. | Length | N.A |

**(g) Cropping Pattern**

| | | |
|---|---|---|
| | Designed | N.A |

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 23% | 3337 |
| ii. | Gram | 8% | 907 |
| iii. | Barley | 1% | 3061 |
| iv. | Vegetables & Fruits | 8% | 221 |
| v. | Mustard | 9% | 1377 |
| vi. | Coriander | 47% | 1098 |
| vii. | Other | 4% | - |

| | |
|---|---|
| **(h) Status of WUA** | Not formed |
| **(i) Status of micro-irrigation** | Nil |

### *5.88.3 Present Status*

The project has been constructed recently and overall efficiency is 57% therefore there is no need to rehabilitate the project.

## 5.89 Raipur Luni Irrigation Project

### *5.89.1 Introduction*

Raipur Luni Irrigation Project has been constructed on Sukri River. The dam and reservoir are situated near Raipur in Raipur Tehsil in Pali District the construction of dam and canal was completed in 1968.

### *5.89.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 370.68 $km^2$ |
| ii. | Free | 325.11 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 6.05 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 2692.74 ha | 2692.74 ha |
| ii. | CCA | 2605.15 ha | 2605.15 ha |
| iii. | Irrigated Area | 1563 ha | No Irrigation have been done for the last ten years |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 12.54 $Mm^3$ |
| ii. | Live | 10.95 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | |
| ii. | Discharge at head | 1.9 cumecs |
| iii. | Length | 10.67 km |
| iv. | Distributory/ Minor | 2. Nos. |
| v. | Length | 12.21 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 36.46% | 1980 |
| ii. | Raida | 59.72% | 932 |

| | | | |
|---|---|---|---|
| iii. | Other | 3.82% | - |

**(g) Status of WUA** 3 Nos. WUA & 1 DC

**(h) Status of micro-irrigation** Nil

### *5.89.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 31% which will further improve by actily involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water courses d/s of outlet in 15 m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 6 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

   As this system is rehabilitated under RWSRP therefore there is no need for further rehabilitation.

## 5.90 Raipur Patan Irrigation Project

### *5.90.1 Introduction*

Raipur Patan Irrigation Project has been constructed on Krisnawati River of Shekhawati Basin. The dam and reservoir are situated near Raipur of Neem ka Thana Tehsil in Sikar District. The construction of dam and canal was completed in 1968.

### *5.90.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 167.9 $km^2$ |
| ii. | Free | 155.4 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | NA |
| ii. | Actual mean yield last 15 years | 2.31 $Mm^3$ |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 2745 ha |
| ii. | CCA | 2207.00 ha |
| iii. | ICA | 951 ha |
| iv. | Intensity of Irrigation | 43% |
| v. | Irrigated Area | 951 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 9.71 $Mm^3$ |
| ii. | Live | 8.32 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 1.467 cumecs |
| iii. | Length | 21.79 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity (In Command Area)**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 27.00% | 3323 |
| ii. | Barley | 5.33% | 2838 |
| iii. | Gram | 6.00% | 960 |
| iv. | Mustard | 37.00% | 1243 |
| v. | Bajra | 10.60% | 476 |
| vi. | Others | 14.07 | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.90.3 Present Status*

The inflow in reservoir is very less therefore no irrigation has been done and the entire storage has been reserved for drinking and water harvesting. As no irrigation is being done from the project this has not been considered for rehabilitation.

## 5.91 Rajsamand Irrigation Project

### *5.91.1 Introduction*

Rajsamand Irrigation Project has been constructed on Gomati River which is a tributary of Banas River of Banas Basin the dam and reservoir are situated near Kankroli Village of Rajsamand Tehsil in Rajsamand District the construction of dam and canal was completed in 1963.

### *5.91.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 523.185 $km^2$ |
| ii. | Free | 432.865 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 41.35 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 16.08 $Mm^3$ |

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 14225 ha |
| ii. | CCA | 10450 ha |
| iii. | Irrigated Area | 7311 ha |
| **(d) Storage Capacity** | | |
| i. | Gross | 107.00 $Mm^3$ |
| ii. | Live | 95.50 $Mm^3$ |
| **(e) Canals** | | |
| i. | Main Canal | Two |
| ii. | Discharge at head | 4.20 cumecs & 1.18 cumecs |
| iii. | Length | 34.440 km & 4.20 km |
| **(f) Cropping Pattern** | | |
| | Designed | NA |

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 80.86% | 2673 |
| ii. | Gram | 0.40% | 502 |
| iii. | Barley | 13.12% | 1978 |
| iv. | Oil Seeds | 2.35% | 546 |
| v. | Other | 3.27% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.91.3 Present Status*

The project has overall efficiency of 16.64%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take from the dam. Channel sections in many reaches are deformed and require resectioning.
2. Banks of canals are deformed /eroded.
3. Existing lined section are damaged and some of reaches are unlined.
4. Numbers of siphons/ VRB are damaged and require the repair.
5. WUAs are not formed.
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.92 Ram Sagar Irrigation Project

### *5.92.1 Introduction*

Ram Sagar Project has been constructed on Bamani River which is a tributary of Parbati River near Bari. The dam and reservoir are situated in Bari Tehsil in Dhaulpur District. The construction of dam and canal was completed in 1905.

### *5.92.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 176.119 $km^2$ |
| ii. | Free | 176.119 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15 years | 22.13 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 6231.40 ha | 6231.40 ha |
| ii. | CCA | 5600.29 ha | 5600.29 ha |
| iii. | Irrigated Area | 3642.3 ha | 1618 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 30.83 $Mm^3$ |
| ii. | Live | 29.39 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.547 cumecs |
| iii. | Length | 11.27 km |
| iv. | Distributaries/ Minor | 15 Nos. |
| v. | Length | 224 km |

**(f) Cropping Pattern**

Design Cropping Pattern NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 47.45% | 3911 |
| ii. | Barley | 0.48% | 3041 |
| iii. | Gram | 1.43% | 1456 |
| iv. | Mustard | 46.86% | 1446 |
| v. | Other | 3.78% | - |

**(g) Status of WUA** 3Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.92.3 Present Status*

The project has been rehabilitated under RWSRP in 2010 and presently the overall efficiency is 30.0% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 3WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.93 Ramgarh Bund Project

### *5.93.1 Introduction*

Ramgarh Bund Project has been constructed across Banganga River the dam and reservoir are situated near Ramgarh of Jaipur Tehsil in Jaipur District. The construction of dam and canal was completed in 1903.

### *5.93.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 769.20 $km^2$ |
| ii. | Free | 731 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | NA |
| ii. | Actual mean yield last 15 years | 9.23 $Mm^3$ |

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 15210 ha |
| ii. | CCA | 1216000 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 75.02 $Mm^3$ |
| ii. | Live | 73.58 $Mm^3$ |

**(e) Status of micro-irrigation** Nil

### *5.93.3 Present Status*

With the Urbanization, the drinking water demand of Jaipur City increased and same was supplemented from Ramgarh Bund. Ultimately a decision was taken to stop irrigation from this bund and reserved the entire storage for drinking water supply to

Jaipur. As no irrigation is being done from this project therefore the project has not been considered for rehabilitation.

## 5.94 Ranapratap Sagar Project

### *5.94.1 Introduction*

The Ranapratap Sagar Project is a second dam of the Chambal Valley Development Project – A joint undertaking of the government of Madhya Pradesh and Rajasthan to utilize. The water of Chambal River and Hydel power generation thereto are to be shared between Madhya Pradesh and Rajasthan in equal proportion. Ranapratap Sagar dam has been constructed in 1970 near Rawat Bhata in Rajasthan, some 56 km downstream of the Gandhi Sagar dam the power plant at Ranapratap Sagar is located on the left bank at the toe of the dam and has an installed capacity of 172 MW (4X43 MW).

### *5.94.2 Important Features*

**(a) Catchment Area**

i. Gross Catchment Area 24864 $km^2$ (2484 $km^2$ with in Rajasthan)

ii. Free Catchment Area 2331 $km^2$

**(b) Storage Capacity**

i. Gross 2898.69 $Mm^3$

ii. Live 1566.53 $Mm^3$

**(c) Status of micro-irrigation** Nil

### *5.94.3 Present Status*

The Ranapratap Sagar Project is a balancing reservoir for power generation and the dam is safe to receive water therefore project is not considered for rehabilitation.

## 5.95 Sainthal Sagar Irrigation Project

### *5.95.1 Introduction*

Sainthal Sagar Irrigation Project has been constructed on Sawa River which is a tributary of Banganga River the dam and reservoir are situated near Dausa of Dausa Tehsil in Dausa District the construction of dam and canal was completed in 1898.

### *5.95.2 Important Features*

**(a) Catchment**

i. Gross 305 $km^2$

ii. Free 255 $km^2$

**(b) Water Availability**

i. Design mean yield NA

ii. Actual mean yield last 15 years 5.16 $Mm^3$

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 4050 ha | 4050 ha |

| | | | |
|---|---|---|---|
| ii. | CCA | 3267 ha | 3267 ha |
| iii. | Irrigated Area | 1176 ha | 700 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 13.73 $Mm^3$ |
| ii. | Live | 1280 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 0.3418 cumecs & 0.7 cumecs |
| iii. | Length | 6.4 km & 14 km |
| iv. | Distributory/Minor | 8 Nos. |
| v. | Length | 22.06 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 31% | 3475 |
| ii. | Gram | 4% | 800 |
| iii. | Barley | 30% | 2520 |
| iv. | Mustard | 32% | 1316 |
| v. | Other | 3% | - |

**(g) Status of WUA** 4 Nos. WUA & 1 DC

**(h) Status of micro-irrigation** Nil

### *5.95.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 65.11% which will further improve by active involvement of WUAs in operational management and the main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water coursed d/s of outlet in 15 m length.
3. Construction of pipe out lets and measuring devices on canal
4. Repair & Construction of VRB.
5. 4 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.96 Sardar Samand Irrigation Project

### *5.96.1 Introduction*

Sardar Samand Irrigation Project has been constructed on Sukaria River of Luni Basin. The dam and reservoir are situated near Sojat City in Sojat Tehsil in Pali District the construction of dam and canal was completed in 1904.

### *5.96.2 Important Features*

**(a) Catchment**

i. Gross 2064 $km^2$

ii. Free 2064 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 13.06 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 13245 ha

ii. CCA 10325 ha

iii. Irrigated Area 8562 ha

**(d) Storage Capacity**

i. Gross 88.23 $Mm^3$

ii. Live 88.23 $Mm^3$

**(e) Canals**

i. Main Two

ii. Length 8.4 km & 9.6 km

iii. Distributory/ Minor 12 Nos.

iv. Length 53.73 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 55.22% | 1980 |
| ii. | Maize | 2.91% | 369 |
| iii. | Barley | 3.43% | 2202 |
| iv. | Raida | 35.07% | 932 |
| v. | Other | 3.37% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.96.3 Present Status*

The project has overall efficiency of 22.79%. It is seen that actual irrigation is much below than designed due to following reasons.

1. Canal capacities are inadequate to cope with peak demand.
2. There are excessive losses in unlined reaches, needs lining.
3. Banks of the canals are deformed/ eroded.
4. Few aqueducts are losing strength, needs guniting.
5. Canals are damaged and required repairing.
6. Number of siphons/ VRB are damaged and require repair.
7. WUAs are not formed.
8. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.97 Sareri Irrigation Project

### *5.97.1 Introduction*

Sareri Irrigation Project has been constructed on Mansi River near town Gulabpura which is a tributary of Khari River of Banas Basin. The dam and reservoir are situated near Gulabpura of Shahpura Tehsil in Bhilwara District the construction of dam and canal was completed in 1957.

### *5.97.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 565 $km^2$ |
| ii. | Free | 369 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | N.A |
| ii. | Actual mean yield last 15 years | 11.68 $Mm^3$ |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 14170 ha |
| ii. | CCA | 97174 ha |
| iii. | Irrigated Area | 6303 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 55.77 $Mm^3$ |
| ii. | Live | 55.10 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 4.78 cumecs & 0.3397 cumecs |
| iii. | Length | 21.60 km & 7.31 km |
| iv. | Minor | 7 Nos. |
| v. | Length of system | 83.02 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 48.79% | 2693 |
| ii. | Gram | 9.69% | 503 |
| iii. | Barley | 6.13% | 2192 |
| iv. | Oil Seeds | 22.56% | 1706 |
| v. | Cotton | 3.40% | 343 |
| vi. | Other | 9.69% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.97.3 Present Status*

The project has overall efficiency of 45.32%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take directly from the dam. Throughout the entire canal system big size outlets are drawing more water. They also require repair.
2. Banks of canals are deformed/eroded.
3. Channel sections in many reaches are deformed and require resectioning.
4. Existing lined section are damaged and mostly reaches are unlined.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.98 Sawan Bhadon Irrigation Project

### *5.98.1 Introduction*

Sawan Bhadon Irrigation Project has been constructed on Aru River which is a tributary of Kalisindh of Chambal Basin. The dam and reservoir are situated near

village Sawan Bhadon of Sangod Tehsil in Kota District the construction of dam and canal was completed in 2001.

### *5.98.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 146.07 $km^2$ |
| ii. | Free | 146.07 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 38.95 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 17.29 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 8190 ha |
| ii. | CCA | 6962 ha |
| iii. | Irrigated Area | 4908 ha (Intensity 70.5%) |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 30.03 $Mm^3$ |
| ii. | Live | 27.846 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 3.055 cumecs |
| iii. | Length | 14.70 km |
| iv. | Distributory/ Minor | N.A |
| v. | Length | 24 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity** N.A

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.98.3 Present Status*

The project has been constructed recently and overall efficiency is 52.5% therefore there is no need to rehabilitate the project.

## 5.99 Sidhmukh Nohar Irrigation Project

### *5.99.1 Introduction*

**General Features**

Sidhmukh and Nohar is an irrigation project under construction, planned to provide perennial irrigation to 114379 ha of land in Nohar and Bhadra Tehsils of

Hanumangarh District and to Rajgarh and Taranagar Tehsils of Churu District, by utilizing 580 $Mm^3$/yr out of Rajasthan's allocated total share of 10.6 $Bm^3$ (8.6 MAF) in surplus Ravi and Beas waters. These supplies for irrigation are planned to be received through the existing Bhakra Canal system, at the tail end of Kishangarh Sub-Branch, through a new link canal at Rajasthan - Haryana border.

Part of Rajasthan's share of 10.6 $Bm^3$ in the Post-Partition surplus Ravi Beas waters is available through the Beas Sutlej Link but the major part is available for Rajasthan at Harike Barrage. On the basis of a 15% share in Beas - Sutlej Link project, Rajasthan is to receive 702 $Mm^3$/yr (0.57 MAF) diverted through this link at Nangal. Accordingly, Rajasthan made a claim for supply of this quantity through Bhakra Canal system for extending irrigation to Sidhmukh and Nohar areas, which could not be included earlier in the command of Bhakra system.

Following the inter-State decisions made in November 1981, the Government of India decided in January 1982 to allow Rajasthan the use of 580 $Mm^3$/yr (0.47 MAF) of the water diverted from Beas to Sutlej, for developing irrigation in Nohar and Sidhmukh areas. To avoid heavy additional costs in remodelling the entire canal system from Nangal Headworks to Rajasthan border, it was decided that a 370 $Mm^3$/yr (0.30 MAF) carrying capacity required for Rajasthan would be saved by transferring areas of South Ghaggar and Jhandwala Distributaries to Rajasthan Feeder, and 210 $Mm^3$/yr (0.17 MAF), equivalent to 8.5 $m^3$/sec (300 cusecs), would be conveyed through the existing Bhakra Main Line (BML) canal, which should be able to carry the additional discharge after completion of the restoration works which would restore it to its original capacity of 354 $m^3$/sec (12,500 cusecs), which is just 2.4% of the authorized full supply discharge (AFSD). Rajasthan is already utilizing 24.2 $m^3$/sec (855 cusecs) of the 354 $m^3$/sec (12,500 cusecs) capacity of this canal. Water is to be delivered at Rajasthan border through Haryana by remodelling the existing Fatheabad Branch, Kishengarh Sub-Branch and Baruwali distributary.

Later on, the two State Governments decided to construct independent parallel canals in Haryana instead of remodelling the above-mentioned canals.

The utilization of 580 $Mm^3$/yr for Sidhmukh and Nohar areas is proposed as follows:

| Description | Capacity $m^3$/sec | Volume $Mm^3$/yr* |
|---|---|---|
| 1. At Rajasthan - Haryana border, at the tail end of Kishangarh Sub-Branch, Link for Nohar area | 6.25 | 154 |
| 2. At Rajasthan - Haryana border, at the tail end of Kishangarh Sub-Branch, Link for Sidhmukh area. | 16.00 | 389 |
| 3. Losses in conveyance canals up to Rajasthan border | 1.25 | 37 |
| Total | 23.50 | 580 |

* At 76% capacity factor

## 1. Main features of the project

The project envisages the works described below in Haryana and Rajasthan:

**a. Work in Haryana**

Construction of three lined feeder canals from Tohana Headworks, including:

1) Sidhmukh and Nohar Feeder, 49 km long, with a carrying capacity of 23.5 $m^3$/sec (829 cusecs), running parallel to the existing Fatheabad Branch, starting from the tail end of BML canal;
2) Sidhmukh Feeder, 38 km long, with a carrying capacity of 16.0 $m^3$/sec (564.34 cusecs), running parallel to the existing Kishangarh Sub-Branch, starting from the tail end of Sidhmukh and Nohar Feeder for Sidhmukh command area;
3) Nohar Feeder, 73 km long, with a carrying capacity of 6.25 $m^3$/sec (220.66 cusecs), running parallel to the existing Baruwali Distributary, starting from the tail end of Sidhmukh and Nohar Feeder, for Nohar command area.

**b. Work in Rajasthan**

1) Construction of Sidhmukh Feeder, parallel to Amarsigh Sub-Branch and Jasana, Raslana and Sidhmukh Distributaries;
2) Construction of a canal system in Hanumangarh and Churu Districts.

### *5.99.2 Important Features*

**(a) Total water allocation to Rajasthan** 580 $Mm^3$

i. Water allocation for irrigation - 555 $Mm^3$

ii. Water allocation for non-irrigation use - 25 $Mm^3$

**(b) Command Area**

i. Total Culturable Command Area 114379 ha

**(c) Intensity of Irrigation**

i. Flow irrigated area 39%

**(d) Main Canal**

i. Discharge at head 16.00&6.25cumecs,

ii. Length

Sidhmukh Feeder 58 km (38km in Haryana &20km in Rajasthan)

Nohar Feeder 73.00km in Haryana

**(e) Status of WUA** Formed

**(f) Status of micro-irrigation** Nil

**(g) Present Cropping Pattern & Productivity**

| | **Crops Kharif** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Cotton | 8.18% | 1219 |
| ii. | Pulses | 4.76% | 515 |
| iii. | Bajra | 4.57% | 1631 |

| | | | |
|---|---|---|---|
| iv. | Ground Nuts | 7.53% | 1935 |
| v. | Paddy | 0.20% | 5119 |
| vi. | Gawar | 70.51% | 829 |
| vii. | Fodder | 4.25% | - |
| viii. | Other | 0.50% | - |
| | **Rabi** | | |
| i. | Wheat | 23.14% | 3537 |
| ii. | Gram | 46.21% | 575 |
| iii. | Mustard | 21.47% | 1588 |
| iv. | Barley | 2.16% | 3078 |
| v. | Fodder | 3.69% | - |
| vi. | Others | 3.33% | - |

### *5.99.3 Present Status*

The Rajiv Gandhi Sidhmukh Nohar Irrigation Project for Culturable Command Area (CCA) of 84170 hectare (ha) under aid programme of European Economic Community was declared completed at a total cost of Rs 258.39 crore in December 2001. Besides, sub-project for construction of Sidhmukh and Ratanpura distributaries for irrigation in CCA of 13600 ha, sanctioned underloan assistance of NABARD due to be completed by March 2001 was still under progress (March 2004) after incurring an expenditure of Rs 18.60 crore. The flow of water in the canal system of Sidhmukh Project under rotation system of Bhakra Beas Management Board (BBMB) started from May2002 but water was not being utilized for irrigation purpose due to non-completion of micro-canalization survey, non preparation of chak planning and non-construction of water courses. In view of above the command area is not fully open and performance of project is to be reviewed so this project has not been considered for rehabilitation.

## 5.100 Sikari Bund Project

### *5.100.1 Introduction*

Sikari Bund Project has been constructed on Ruparail River the dam and reservoir are situated near Sikari of Bayana Tehsil in Bharatpur District the construction of dam and canal was completed in State time.

### *5.100.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1375.6 $km^2$ |
| ii. | Free | 982 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | NA |
| ii. | Actual mean yield last 15 years | No adequate water received in dam for the last 15 years |

**(c) Command Area** **Designed**

i. GCA 10467 ha

ii. CCA 10467 ha

iii. Irrigated Area 10467 ha

**(d) Storage Capacity**

**It is a Diversion dam**

**(e) Canals**

i. Main Canal 28

ii. Total Length 140 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 31.0% | 3921 |
| ii. | Gram | 4.5% | 1197 |
| iii. | Barley | 30.0% | 3178 |
| iv. | Mustard | 32.0% | 1730 |
| v. | Maithi | 1.0% | 1167 |
| vi. | Other | 1.5% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.100.3 Present Status*

It is reported that from the last 15 years, there has been practically no inflow in the reservoir. Therefore as far as surface water project is concerned this stands virtually abandoned. There is no other source of water from which water can be diverted to this dam for irrigation in the command hence no action for rehabilitation is needed.

## 5.101 Som Kamla Amba Irrigation Project

### *5.101.1 Introduction*

Som Kamla Amba Project has been constructed on Som River which is a tributary of Mahi River near village Kamla Amba the dam and reservoir are situated in Dungarpur Tehsil in Dungarpur District. The construction of dam and canal was completed in 1999.

### *5.101.2 Important Features*

**(a) Catchment**

i. Gross 5376 Sq km

ii. Free 1242 Sq km

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 163.92 $Mm^3$ |
| ii. | Actual mean yield last 12 years | 134.24 $Mm^3$ |

**(c) Planned Utilization**

| | | |
|---|---|---|
| i. | Domestic water | 8 $Mm^3$ |
| ii. | Irrigation water | 140.6 $Mm^3$ |

**(d) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 25080 ha |
| ii. | CCA | 19719 ha |

**(e) Irrigated Area**

| | | |
|---|---|---|
| i. | Kharif | 11420 ha |
| ii. | Rabi | 10128 ha |

**(f) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 172.80 $Mm^3$ |
| ii. | Live | 160.30 $Mm^3$ |

**(g) Canals**

| | **Main Canal** | **LMC** | **RMC** | **Bhabrana Branch** |
|---|---|---|---|---|
| i. | Discharge at head | 0.36 cumecs | 6.60 cumecs | 2.71 cumecs |
| ii. | Length | 9.69 km | 19.68 km | 23.19 km |
| iii. | Distributaries/ Minor | 57 Nos. | | |
| iv. | Length | 200 cumecs km | | |

**(h) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 97.85% | 1779 |
| ii. | Gram | 0.58% | 1426 |
| iii. | Barley | 0.79% | 1039 |
| iv. | Mustard | 0.08% | 1207 |
| v. | Maithi | 0.06% | 719 |

**(i) Status of WUA** Not formed

**(j) Status of micro-irrigation** Nil

### *5.101.3 Present Status*

The project has been completed in year 1995 and in 1999 a high level Bhabarna Canal has been conceived. However, construction of this new canal system is still in

progress. In year 2010-11 overall efficiency is 42.88% and this will further improve by active involvement of WUAs in operational management and completion of complete system.

Due to the reasons mentioned above the project has not been considered for rehabilitation.

## 5.102 Som Kagdar Irrigation Project

### *5.102.1 Introduction*

Som Kagdar Project has been constructed on Som River which is a tributary of Mahi River near village Kagdar the dam and reservoir are situated in Kherwara Tehsil in Udaipur District. The construction of dam and canal was completed in 1983.

### *5.102.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 748 $km^2$ |
| ii. | Free | 564 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | 79.30 $Mm^3$ |
| ii. | Actual mean yield last 12 years | 134.24 $Mm^3$ |

**(c) Planned Utilization**

| | | |
|---|---|---|
| i. | Domestic water | 8 $Mm^3$ |
| ii. | Irrigation water | 26.44 $Mm^3$ |

| | | |
|---|---|---|
| **(d) Command Area** | | **Designed** |
| i. | GCA | 9887 ha |
| ii. | CCA | 5739 ha |

**(e) Irrigated Area**

| | | |
|---|---|---|
| i. | Kharif | 1549 ha |
| ii. | Rabi | 3386 ha |

**(f) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 36.19 $Mm^3$ |
| ii. | Live | 34.44 $Mm^3$ |

**(g) Canals**

| | | |
|---|---|---|
| i. | Main Canal | RMC |
| ii. | Discharge at head | 3.6 cumecs |
| iii. | Length | 12.31 km |
| iv. | LMC, Distributaries/Minor | 14 Nos. |
| v. | Length | 83.54 km |

**(h) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 92.58% | 2340 |
| ii. | Barley | 5.00% | 1807 |
| iii. | Gram | 2.22% | 1060 |
| iv. | Vegetables, Rijika & Others | 0.20% | - |

**(i) Status of WUA** 19WUA, But not functional

**(j) Status of micro-irrigation** Nil

### *5.102.3 Present Status*

The project has been completed in year 1983. In year 2010-11 overall efficiency is 43.5% and this can be further improved by active involvement of WUAs in operational management and removing major deficiencies as discussed under.

1. Providing gauge wells at the head of RMC and LMC.
2. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
3. New lining in Vulnerable Reaches and Repair of damaged lining, regulators & aqueduct.
4. Construction of pipe out lets and measuring devices on canal.
5. Repair & Construction of VRB.
6. Reformation of WUAs.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.103 Sukli Selwara Irrigation Project

### *5.103.1 Introduction*

Sukli Selwara Irrigation Project has been constructed on Sukli River the dam and reservoir are situated near village Selwara of Reodar Tehsil in Sirohi District the construction of dam and canal was completed in 2008.

### *5.103.2 Important Features*

**(a) Catchment**

i. Gross 277.10 $km^2$

ii. Free 223.3 $km^2$

**(b) Water Availability**

i. Design mean yield - 29.62

ii. Actual mean yield last 15 years 7.8 $Mm^3$ (Average of year 2007 to 2010)

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 6820.35 ha |
| ii. | CCA | 5000 ha |
| iii. | ICA | 5000 ha |
| iv. | Irrigated Area | 5000 ha |
| **(d) Storage Capacity** | | |
| i. | Gross | 29.51 $Mm^3$ |
| ii. | Live | 25.58 $Mm^3$ |
| **(e) Canals** | | |
| i. | Main Canal | Two |
| ii. | Length | 17.96 km & 10.500 km |
| iii. | Distributory/Minor | 5 Nos. |
| iv. | Length | 16.307 km |
| **(f) Cropping Pattern** | | |
| **Designed Cropping Pattern** | | |
| | **Kharif** | |
| i. | Bajra | 75% |
| ii. | Guar | 15% |
| iii. | Kharif Pulses | 10% |
| | **Rabi** | |
| i. | Wheat | 17% |
| ii. | Gram | 7% |
| iii. | Barley | 2% |
| iv. | Mustard | 56% |
| v. | Cumin/Sagol | 16% |
| vi. | Rabi Fodder | 2% |
| **(g) Status of WUA** | | Not formed |
| **(h) Status of micro-irrigation** | | Nil |

### *5.103.3 Present Status*

The project has been constructed recently and designed overall efficiency is 57% therefore there is no need to rehabilitate the project.

## 5.104 Surwal Irrigation Project

### *5.104.1 Introduction*

Surwal Sagar Irrigation Project has been constructed on Local Nallah which is a tributary of Banas River the dam and reservoir are situated near Gothra of Sawai

Madhopur Tehsil in Sawai Madhopur District the construction of dam and canal was completed in 1957.

### *5.104.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 233 $km^2$ |
| ii. | Free | 178 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | 23.95 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 5.65 $Mm^3$ |

| **(c) Command Area** | **Designed** | **Actual** |
|---|---|---|
| i. GCA | 4910 ha | 4910 ha |
| ii. CCA | 4129 ha | 4129 ha |
| iii. Irrigated Area | 3300 ha | 2160 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 25.97 $Mm^3$ |
| ii. | Live | 25.55 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 2.730 cumecs |
| iii. | Length | 17.526 km |
| iv. | Distributory/Minor | 5 Nos. |
| v. | Length | 21.28 km |

**(f) Cropping Pattern**

Designed N.A

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 43.74% | 3484 |
| ii. | Gram | 53.53% | 1044 |
| iii. | Barley | 1.76% | 1975 |
| iv. | Mustard | 0.11% | 1109 |
| v. | Other | 0.86% | - |

**(g) Status of WUA** 2 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.104.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 42.75% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water courses d/s of outlet in 15 m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 2 WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.105 Surwania Irrigation Project

### *5.105.1 Introduction*

Surwania Irrigation Project has been constructed on Local Nallah which is a tributary of Mahi of Mahi Basin. The dam and reservoir are situated near village Survania of Banswara Tehsil in Banswara District the construction of dam and canal was completed in 1962.

### *5.105.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 93.24 $km^2$ |
| ii. | Free | 93.24 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | 22 $Mm^3$ |
| ii. | Actual mean yield | (Dam filled from Mahi dam water whenever required) |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 2660 ha |
| ii. | CCA | 2229 ha |
| iii. | Irrigated Area | 1340 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 13.19 $Mm^3$ |
| ii. | Live | 11.33 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 1.23 cumecs |

| | | |
|---|---|---|
| iii. | Length | 25.14 km |
| iv. | Distributory/ Minor | N.A |
| v. | Length | N.A |

**(f) Status of WUA** Not formed

**(g) Status of micro-irrigation** Nil

### *5.105.3 Present Status*

The project has been located in Command of Mahi Project and the Left Canal escape has been providing water whenever required to full-fill the requirement of drinking water of Banswara Town as well as irrigation therefore this project is merged in Mahi Project. Therefore this project will be taken up for rehabilitation with Mahi Project.

## 5.106 Takli Irrigation Project

### *5.106.1 Introduction*

Takli Irrigation Project has been constructed on Takli River which is a tributary of Amjhar River of Chambal Basin. The dam and reservoir are situated near village Dhankuja of Ramganj Mandi Tehsil in Kota District the construction of dam and canal was completed in 2012.

### *5.106.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 257.75 $km^2$ (62.15 $km^2$ in Rajasthan) |
| ii. | Free | 249.5 $km^2$ (62.15 $km^2$ in Rajasthan) |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | 15.09 $Mm^3$ (based on 100% catchment of in Rajasthan and 10% of M.P. to account for regeneration) |
| ii. | Actual mean yield last 15 years | N.A |

| | | |
|---|---|---|
| **(c) Command Area** | | **Designed** |
| i. | GCA | 8033 ha |
| ii. | CCA | 7386 ha |
| iii. | Irrigated Area | 6648 ha (Intensity 90.0%) |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 33.74 $Mm^3$ |
| ii. | Live | 29.90 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | cumecs |
| iii. | Length | 14.70 km |
| iv. | Distributory/ Minor | N.A |

v. Length 24 km

**(f) Cropping Pattern**

Designed N.A

**Present Cropping Pattern & Productivity** N.A

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.106.3 Present Status*

The project has been constructed recently and overall efficiency is 52.5% therefore there is no need to rehabilitate the project.

## 5.107 Tordi Sagar Irrigation Project

### *5.107.1 Introduction*

Tordi Sagar Irrigation Project has been constructed on Shodra River near Tordi which is a tributary of Banas River the dam and reservoir are situated near Tordi of Todaraisingh Tehsil in Tonk District the construction of dam and canal was completed in 1888.

### *5.107.2 Important Features*

**(a) Catchment**

i. Gross 704.88 $km^2$

ii. Free 704.88 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 10.75 $Mm^3$

**(c) Command Area** **Designed**

i. CCA 13391 ha

ii. Irrigated Area 8372 ha

**(d) Storage Capacity**

i. Gross 47.12 $Mm^3$

ii. Live 47.12 $Mm^3$

**(e) Canals**

i. Main Canal Three

ii. Discharge at head 3.96 cumecs, 3.40 cumecs & 2.54 cumecs

iii. Length 26.760 km, 16.950 km, 24.390 km

iv. Distributory/Minor 14 Nos.

v. Length 80.52 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 54.20% | 2673 |
| ii. | Gram | 7.91% | 502 |
| iii. | Barley | 24.20% | 1978 |
| iv. | Oil Seeds | 11.77% | 769 |
| v. | Pulses | 0.16% | 828 |
| vi. | Other | 1.76% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.107.3 Present Status*

The project has overall efficiency of 28.43%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The Tordi Sagar Project canal system comprises of three main canals which off take directly from the dam. Throughout the entire canal system no cross regulators across main canals, big size outlets are drawing more water. They also require repairs.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed.
4. Existing lined section are damaged.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.108 Udai Sagar Irrigation Project

### *5.108.1 Introduction*

Udai Sagar Irrigation Project has been constructed on Berach River near Bhichri which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Bhichri of Girwa Tehsil in Udaipur District the construction of dam and canal was completed in 1964.

### *5.108.2 Important Features*

**(a) Catchment**

i. Gross 477.00 $km^2$

ii. Free 196 $km^2$

**(b) Water Availability**

i. Design mean yield - 22.13 $Mm^3$

ii. Actual mean yield last 15 years 7.94 $Mm^3$

| **(c) Command Area** | **Designed** |
|---|---|
| i. GCA | 5092.00 ha |
| ii. CCA | 4650 ha |
| iii. Irrigated Area | 1943 ha |

| **(d) Storage Capacity** | |
|---|---|
| i. Gross | 31.14 $Mm^3$ |
| ii. Live | 27.59 $Mm^3$ |

| **(e) Canals** | |
|---|---|
| i. Main Canal | Two |
| ii. Discharge at head | 2.3747 cumecs & 0.796 cumecs |
| iii. Length | 27 km &14 km |
| iv. Distributory/ Minor | 10 Nos. |
| v. Length of system | 37.97 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 71.95% | 2340 |
| ii. | Gram | 1.81% | 1060 |
| iii. | Barley | 8.86% | 1807 |
| iv. | Oil Seeds | 15.48% | 693 |
| v. | Other | 1.90% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.108.3 Present Status*

The project has overall efficiency of 16.09%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. Banks of canals are deformed /eroded.
2. Channel sections in many reaches are deformed and require resectioning.
3. Existing lined section are damaged and mostly reaches are unlined.
4. Numbers of siphons/ VRB are damaged and requires repair

5. WUAs are not formed
6. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.109 Ummed Sagar Irrigation Project (Bhilwara)

### *5.109.1 Introduction*

Ummed Sagar Irrigation Project has been constructed on Khari which is a tributary of Khari River of Banas Basin. The dam and reservoir are situated near Amarpura of Shahpura Tehsil in Bhilwara District the construction of dam and canal was completed in 1917.

### *5.109.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 407 $km^2$ |
| ii. | Free | 174 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 28.00 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 6.95 $Mm^3$ |

**(c) Command Area** **Designed**

| | | |
|---|---|---|
| i. | GCA | 3837 ha |
| ii. | CCA | 2968 ha |
| iii. | Irrigated Area | 2543 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 17.77 $Mm^3$ |
| ii. | Live | 17.77 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Four |
| ii. | Discharge at head | 1.17 cumecs , 0.03 cumecs, 0.15 cumecs & 0.09 cumecs |
| iii. | Length | 17.14 km, 2.3 km, 2 km & 1.7 km |
| iv. | Length of system | 24.35 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 55.99% | 2693 |
| ii. | Gram | 13.00% | 503 |
| iii. | Coriander | 0.01% | 1187 |

| | | | |
|---|---|---|---|
| iv. | Oil Seeds | 22.56% | 1706 |
| v. | Soyabean | 3.40% | 684 |
| vi. | Other | 5.04% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.109.3 Present Status*

The project has overall efficiency of 40%. It is seen that actual overall efficiency is below than designed due to following reasons.

1. The project canal system comprises of four main canals which off take directly from the dam. Throughout the entire canal system, there exist no cross regulators across main canals, big size outlets are drawing more water. They also require repair.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed and require resectioning.
4. Existing lined section are damaged and some reaches are unlined.
5. Numbers of siphons/ VRB are damaged and require repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.110 Umed Sagar Irrigation Project (Baran)

### *5.110.1 Introduction*

Umed Sagar Irrigation Project has been constructed on Kui River near Pagara which is a tributary of Chambal River the dam and reservoir are situated near Pagara of Kishanganj Tehsil in Baran District the construction of dam and canal was completed in 1935.

### *5.110.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 513 $km^2$ |
| ii. | Free | 480.6 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield | NA |
| ii. | Actual mean yield last 15 years | 17.49 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 5837 ha | 5837 ha |
| ii. | CCA | 2968 ha | 2968 ha |
| iii. | Irrigated Area | 3246 ha | 2540 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 18.88 $Mm^3$ |
| ii. | Live | 18.60 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Discharge at head | 09 , 0.14, 1.175, 0.03 & 0.02cumecs |
| ii. | Length | 2.44 km, 2.44 km, 8.53 km, 1 km & 6.55 km, |
| iii. | Branch/Distributory/Minor | 4 Nos. |
| iv. | Length | 10.05 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 97.28% | 2228 |
| ii. | Gram | 0.15% | 1028 |
| iii. | Barley | 0.11% | 2192 |
| iv. | Oil Seeds | 1.58% | 1109 |
| v. | Coriander | 0.84% | 1265 |
| vi. | Other | 0.04% | - |

**(g) Status of WUA** 3 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.110.3 Present Status*

The project has been rehabilitated under RWSRP in year 2009 and presently the overall efficiency is 40% which will further improve by active involvement of WUAs in operational management and the main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. Conversion of unlined canal into lined canal.
3. Pipe out let have been replaced to gate.
4. Repair & Construction of VRB.
5. 3WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.111 Urmila Sagar Irrigation Project

### *5.111.1 Introduction*

Urmila Sagar Project has been constructed on Babudhen River which is a tributary of Parbati River near Dhaulpur. The dam and reservoir are situated in Dhaulpur Tehsil in Dhaulpur District. The construction of dam and canal was completed in 1905.

### *5.111.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 77.7 $km^2$ |
| ii. | Free | 77.7 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | N.A |
| ii. | Actual mean yield last 15years | 10.58 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 3138.45 ha | 3138.45ha |
| ii. | CCA | 2900 ha | 2900 ha |
| iii. | Irrigated Area | 1535 ha | 1535 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 16.22 $Mm^3$ |
| ii. | Live | 15.14 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | One |
| ii. | Discharge at head | 1.076 cumecs |
| iii. | Length | 15.7 km |
| iv. | Distributaries/ Minor | 7 Nos. |
| v. | Length | 224 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 49.73% | 3911 |
| ii. | Barley | 0.46% | 3041 |
| iii. | Gram | 0.76% | 1452 |
| iv. | Mustard | 43.71% | 1446 |
| v. | Others | 5.34% | - |

**(g) Status of WUA** 3 Nos. WUA & 1DC

**(h) Status of micro-irrigation** Nil

### *5.111.3 Present Status*

The project has been rehabilitated under RWSRP in 2010 and presently the overall efficiency is 40.46% which will further improve by active involvement of WUA in

operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 3WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As the system is already rehabilitated under RWSRP there is no need for further rehabilitation.

## 5.112 Vallabh Nagar Irrigation Project

### *5.112.1 Introduction*

Vallabh Nagar Irrigation Project has been constructed on Berach River which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Ranchorpur of Vallabh Nagar Tehsil in Udaipur District the construction of dam and canal was completed in 1966.

### *5.112.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 1200.64 $km^2$ |
| ii. | Free | 458.24 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 33.03 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 4.07 $Mm^3$ |

| **(c) Command Area** | | **Designed** |
|---|---|---|
| i. | GCA | 8405 ha |
| ii. | CCA | 6464 ha |
| iii. | Irrigated Area | 3238 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 30.46 $Mm^3$ |
| ii. | Live | 28.78 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 3.11 cumecs & 0.15 cumecs |
| iii. | Length | 12600 km & 5.40 km |
| iv. | Distributory/Minor | 10 Nos. |
| v. | Length of System | 35.55 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | Crops | Cropping Pattern | Productivity (Kg/ha) |
|---|---|---|---|
| i. | Wheat | 65.00% | 2340 |
| ii. | Gram & Other Pulses | 0.84% | 544 |
| iii. | Barley | 5.00% | 1807 |
| iv. | Oil Seeds | 25.24% | 693 |
| v. | Other | 3.92% | - |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.112.3 Present Status*

The project has overall efficiency of 12%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of two main canals which off take directly from the dam. Throughout the entire canal system, there exist no cross regulators across main canals, big size outlets are drawing more water. They also require repair.
2. Banks of canals are deformed /eroded.
3. Channel sections in many reaches are deformed and require resectioning.
4. Existing lined section are damaged and mostly reaches are unlined and requires resectioning.
5. Numbers of siphons/ VRB are damaged and require the repair.
6. WUAs are not formed.
7. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.113 Wagan Irrigation Project

### *5.113.1 Introduction*

Wagan Irrigation Project has been constructed on Wagan River which is a tributary of Banas River of Banas Basin. The dam and reservoir are situated near Pholodra of Doongla Tehsil in Chittaurgarh District the construction of dam and canal was completed in 1982.

### *5.113.2 Important Features*

**(a) Catchment**

i. Gross 307 $km^2$

ii. Free 256 $km^2$

**(b) Water Availability**

i. Design mean yield - N.A

ii. Actual mean yield last 15 years 15.86 $Mm^3$

**(c) Command Area** **Designed**

i. GCA 9790 ha

ii. CCA 8270 ha

iii. Irrigated Area 5541 ha

**(d) Storage Capacity**

i. Gross 40.65 $Mm^3$

ii. Live 37.58 $Mm^3$

**(e) Canals**

i. Main Canal Three

ii. Discharge at head 2.06 cumecs, 1.10 cumecs 0.172 cumecs

iii. Length 23.30 km, 18.45 km & 4.00 km

iv. Distributory/Minor 9 Nos.

v. Length of system 30.79 km

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| | **Rabi** | | |
| i. | Wheat | 61.40% | 3295 |
| ii. | Barley | 3.51% | 2886 |
| iii. | Gram | 0.95% | 946 |
| iv. | Mustard | 27.43% | 1223 |
| v. | Other Rabi pulses | 0.70% | 749 |
| vi. | Others | 5.77% | - |
| | **Total** | **100%** | |

**(g) Status of WUA** Not formed

**(h) Status of micro-irrigation** Nil

### *5.113.3 Present Status*

The project has overall efficiency of 17.32%. It is seen that actual overall efficiency is much below than designed due to following reasons.

1. The project canal system comprises of three canals which off take from the dam. Existing lined section are damaged and mostly reaches are unlined and requires resectioning and lining.
2. Banks of canals are deformed /eroded.
3. Numbers of siphons/ VRB are damaged and require repair.

4. WUAs are not formed.
5. Warabandi system is not enforced.

Due to the reasons mentioned above the project requires rehabilitation.

## 5.114 West Banas Irrigation Project

### *5.114.1 Introduction*

West Banas Irrigation Project has been constructed on West Banas River the dam and reservoir are situated near Dhanni in Pindwara Tehsil in Sirohi District the construction of dam and canal was completed in 1965.

### *5.114.2 Important Features*

**(a) Catchment**

| | | |
|---|---|---|
| i. | Gross | 507.6 $km^2$ |
| ii. | Free | 501.80 $km^2$ |

**(b) Water Availability**

| | | |
|---|---|---|
| i. | Design mean yield - | 89 $Mm^3$ |
| ii. | Actual mean yield last 15 years | 20.78 $Mm^3$ |

| **(c) Command Area** | | **Designed** | **Actual** |
|---|---|---|---|
| i. | GCA | 9848 ha | 9848 ha |
| ii. | CCA | 7952 ha | 7952 ha |
| iii. | ICA | 5566 ha | 5566 ha |
| iv. | Intensity of Irrigation | 70% | |
| v. | Irrigated Area | 5566 ha | 5566 ha |

**(d) Storage Capacity**

| | | |
|---|---|---|
| i. | Gross | 39.05 $Mm^3$ |
| ii. | Live | 36.22 $Mm^3$ |

**(e) Canals**

| | | |
|---|---|---|
| i. | Main Canal | Two |
| ii. | Discharge at head | 3.2 cumecs & 1.0 cumecs |
| iii. | Length | 34.747 km & 22 km |
| iv. | Distributory/ Minor | 5 Nos. |
| v. | Length | 16.29 km |

**(f) Cropping Pattern**

Designed NA

**Present Cropping Pattern & Productivity**

| | **Crops** | **Cropping Pattern** | **Productivity (Kg/ha)** |
|---|---|---|---|
| i. | Wheat | 69.2% | 2449 |

| | | | |
|---|---|---|---|
| ii. | Gram | 11.2% | 663 |
| iii. | Barley | 6.5% | 2202 |
| iv. | Oil Seeds | 11.2% | 900 |
| v. | Vegetables | 0.3% | 281 |
| vi. | Other | 1.1% | - |

**(g) Status of WUA** 8 Nos. WUA &1 DC

**(h) Status of micro-irrigation** Nil

### *5.114.3 Present Status*

The project has been rehabilitated under RWSRP in 2008 and presently the overall efficiency is 44.2% which will further improve by active involvement of WUAs in operational management. The main system improvement works have been carried out which are as under.

1. Redesigning of canal section and distribution system to carry out design water allowances equitably throughout the command.
2. New lining in Vulnerable Reaches and lining of water courses d/s of outlet in 15m length.
3. Construction of pipe out lets and measuring devices on canal.
4. Repair & Construction of VRB.
5. 8WUA (Water Users Association) have been formed (elected) to improve overall water management practices.

As this system is rehabilitated under RWSRP there is no need for further rehabilitation.

## 6. Recently Rehabilitated Existing Major and Medium Projects

In order to improve the performances of irrigation projects State Government has recently rehabilitated the following major and medium projects under the Rajasthan Water Sector Restructuring Project as given below.

Table 6.1 List of Projects Rehabilitated Under RWSRP

| | | | |
|---|---|---|---|
| 1. | Bhakra Canal | 22. | Hemawas |
| 2. | Gang Canal | 23. | Kharda |
| 3. | Guda | 24. | Raipur Luni |
| 4. | Jawai | 25. | Ora |
| 5. | Galwa | 26. | Angore |
| 6. | Morel | 27. | West Banas |
| 7. | Parbati | 28. | Mashi |
| 8. | Kota Barrage | 29. | Chittoli |
| 9. | Parwan | 30. | Buchara |
| 10. | Ummed Sagar | 31. | Kharad |
| 11. | Burdha | 32. | Kalakho |
| 12. | Bhimlat Abaypura | 33. | Sainthal Sagar |
| 13. | Bundi ka Gothra | 34. | Mora Sagar |
| 14. | Bhim Sagar | 35. | Mansarovar |
| 15. | Alnia | 36. | Surwal |
| 16. | Nand Samand | 37. | Juggar |
| 17. | Jetpura | 38. | Jaisamand (Alwar) |
| 18. | Nahar Sagar | 39. | Baretha |
| 19. | Orai | 40. | Urmila Sagar |
| 20. | Gambhiri | 41. | Ram Sagar |
| 21. | Bankli | 42. | Moti Sagar |

The performance of 30 out of 42 Rehabilitated Projects have been evaluated (in 2010&2011) as per data availability and are given in Table 6.2.

Table No. 6.2 Performance of Selected Rehabilitated Project under RWSRP

| S.No | Key Indicators | Measures | Jawai | Parbati | Galwa | Surwal | Mashi | Nand Samand | Orai | Gudha | Kota Barrage | Ummed Sagar | Bhimlat Abhaypura | Burdha | Man Sarovar | West Banas |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | End- Monsoon Storage | % of Gross Capacity | 53.00% | 77.00% | 52.30% | 78.00% | 89.00% | 87.00% | - | 83.70% | - | 91.84% | 98.00% | 93.00% | 94.00% | 89.75% |
| | | % of Monsoon Inflow | - | 108.00% | - | 85.00% | - | 16.40% | 93.00% | 94.70% | 25.80% | - | 72.40% | 63.00% | - | 90.30% |
| 2 | Rabi Period Withdrawal by main Canal | % of End-Monsoon Storage | 46.50% | 81.70% | 55.50% | 69.35% | 57.00% | 71.00% | 59.80% | 76.23% | - | 71.90% | 62.00% | 64.00% | 79.00% | 61.30% |
| 3 | Canal System (or Water Delivery) Efficiency | Total water Delivered at Outlets as % of Withdrawal by Canal System(s) | 79.25% | 75.00% | 71.90% | 75.00% | 74.00% | 75.00% | 61.00% | 77.00% | 64.90% | 79.00% | 71.40% | 76.00% | 78.00% | 85.00% |
| 4 | On- Farm Efficiency | Total Crop Consumption as % of Total Water Delivered at Outlets in the System | 62.00% | 61.00% | 67.60% | 57.00% | 59.00% | 56.00% | 57.00% | 60.00% | 48.50% | 51.00% | 56.00% | 63.00% | 58.00% | 52.00% |
| 5 | Irrigation System Efficiency (Rabi Season) | Product of Canal and On –Farm System Efficiency | 49.10% | 46.00% | 46.00% | 43.00% | 44.00% | 42.00% | 35.00% | 46.20% | 32.00% | 40.00% | 47.00% | 48.00% | 49.00% | 44.20% |
| 6 | Water Use Efficiency(ha/$Mm^3$) | | 197 | 132 | 503.86 | 173.5 | 391 | 225 | 219 | 135 | - | 129 | 221.6 | 248 | 234 | 259 |

Sources: Results are compiled from the study "Benchmarking and Water Auditing of Rehabilitated existing project under Water Resource Department Rajasthan done by WAPCOS & Final Evaluation Report by EGIS

Table No. 6.2 Performance of Selected Rehabilitated Project under RWSRP (Continued)

| S.No | Key Indicators | Measures | Parwan | Bundi ka Gothra | Bhim Sagar | Alnia | Jetpura | Nahar sagar | Gambhiri | Kharda | Ora | Angore | Sainthal Sagar | Mora Sagar | Urmila Sagar | Ram Sagar | Bhankra Canal | Gang Canal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | End- Monsoon Storage | % of Gross Capacity | _ | 96.20% | 100% | 99.10% | 100% | 22.50% | 100% | 15.20% | 58.80% | 99.20% | 14.40% | 13.90% | 69.00% | 98.50% | _ | _ |
| | | % of Monsoon Inflow | | _ | | | | | | | | | | | | | | |
| 2 | Rabi Period Withdrawal by main Canal | % of End-Monsoon Storage | - | 91.56% | 66.00% | 89.99% | 84.96% | 58.33% | 88.47% | 36.28% | 79.43% | 67.86% | 61.35% | 50.97% | 46.02% | 69.88% | _ | _ |
| 3 | Canal System (or Water Delivery) Efficiency | Total water Delivered at Outlets as % of Withdrawal by Canal System(s) | 47.64% | 64.32% | 56.68% | 69.88% | 70.24% | 64.14% | 55.98% | 78.50% | 85.89% | 80.08% | 84.29% | 80.00% | 82.36% | 52.42% | 83.00% | 71.49% |
| 4 | On- Farm Efficiency | Total Crop Consumption as % of Total Water Delivered at Outlets in the System | 76.68% | 77.96% | 51.00% | 74.09% | 66.28% | 75.73% | 65.36% | 74.87% | 57.80% | 67.77% | 77.25% | 59.72% | 49.12% | 56.63% | 63.56% | 53.60% |
| 5 | Irrigation System Efficiency (Rabi Season) | Product of Canal and On –Farm System Efficiency | 36.53% | 50.15% | 28.91% | 51.77% | 46.56% | 48.57% | 36.59% | 58.77% | 49.65% | 54.27% | 65.11% | 47.78% | 40.46% | 29.69% | 52.66% | 38.32% |
| 6 | Water Use Efficiency (ha/Mm$^3$) | | 253.33 | 192.65 | 194.75 | 220.27 | 157.17 | 279.45 | 110.81 | 193.67 | 650.76 | 262.89 | 357.02 | 372.34 | 146.41 | 103.63 | 301.48 | 288.62 |

Sources: Results are compiled from the study "Benchmarking and Water Auditing of Rehabilitated existing project under Water Resource Department Rajasthan done by WAPCOS & Final Evaluation Report by EGIS.

## 6.1 Conclusion

Based on studies on 30 rehabilitated projects following conclusion are drawn:

1. During the year under study (2011&2010) the percentage of end monsoon to gross capacity ranges between 14% to 100%.
2. The canal system delivery (off farm) efficiencies ranges between 48% to 85%. The average efficiency is 72.31%.
3. The on farm efficiency ranges between 48.50% to 77.96% and average on farm efficiency is set on 61.85%, which is significantly lower than expected as per original design which can be improved by following operational management.

(i) WUA's should be encouraged to be actively involved in water allocation and distribution and to ensure equity in respect to head, middle and tail reaches.

(ii) Removal of all unauthorized outlets / lift on the system.

(iii) Night irrigation should be promoted to save on operational losses below the outlet and improve field efficiency.

(iv) Warabandi should be enforced.

4. The irrigation system efficiency at scheme level ranges between 28.91% to 65.10% and average work out to 44.91% which is also significantly lower than the original design. This can be improved by operation management as discussed in point 3 above.

# 7. Identification of Projects to be Rehabilitated

There are 114 major and medium irrigation projects (considering Bhimlat-Abheypura as one and including canal projects having imported surface water). Out of the 114 Projects, 42 major and medium projects (see Table 6.1) are under rehabilitation under RWSRP and performances of some of the projects show that these projects do not require further rehabilitation. For the projects which were commissioned recently, it has been observed that there is no requirement for rehabilitation and modernization due to area is not fully developed or open for irrigation. Therefore, the remaining project for which water is stored in reservoir at regular interval and is being used for irrigation are considered as projects for rehabilitation and studied in detail as listed in Table 9.1.

# 8. Unit Cost Analysis for Rehabilitation Works

A unit cost basis is developed by the Consultant for the purpose of estimating the investments and operational costs of the improvement plans and is implemented within the economic analysis and prioritization.

As a basis for estimating the cost of rehabilitation and modernization works required in existing irrigation projects, the Consultant have analyzed the proposals which were formulated by the irrigation department in the framework of the (RWSRP) Rajasthan Water Sector Restructuring Project. This analysis provides a set of unit costs per hectare of irrigation canal system and unit costs per $m^3$ for rehabilitation and modernization of dam (head work).

Unit costs for the construction of wells, feeder canals, etc., and the costs of pumping equipment and pumping energy, have also been estimated, both for capital and O&M

costs and for groundwater utilization and surface water lifting. The detailed unit cost analysis are given in Annex 1.

# 9. Appraisal of the Identified Project for Rehabilitation

## 9.1 General Projects' description

Project appraisals were carried out for identified Major and Medium projects.

The general review covered the following aspects:

(i) Availability of surface water.
(ii) Adequacy of the existing storage capacity.
(iii) Adequacy of existing CCA.

As a result, suggestions were made for changes such as: increasing the storage capacity if possible, if additional surface water was found to be available; expanding (or reducing) the CCA; introducing changes in the main canal system and other changes in existing projects.

The projects selected for detailed appraisal are listed in Table 9.1. Map showing location of these projects is given at the end of this Report (in back-pocket).

Table 9.1 Projects Selected for Detailed Appraisal for Rehabilitation

| S. No. | Basin | Project |
|---|---|---|
| 1 | Shekhawati Basin | Nil |
| 2 | Ruparail Basin | Nil |
| 3 | Banganga Basin | Madho Sagar |
| 4 | Gambhir Basin | Nil |
| 5 | Parbati Basin | Nil |
| 6 | Sabi Basin | Nil |
| 7 | Banas Basin | Arwar |
| | | Badgaon |
| | | Bagolia |
| | | Bassi |
| | | Bhopal Sagar |
| | | Chandra Bhaga |
| | | Chandsen |
| | | Chhaparwara |
| | | Dheel |
| | | Dindoli |
| | | Kalisil |
| | | Khari |
| | | Kothari |
| | | Lassaria |
| | | Mataji Ka Khera |
| | | Meja |
| | | Murlia |
| | | Narain Sagar Jalia |
| | | Rajsamand |
| | | Sareri |

| S. No. | Basin | Project |
|---|---|---|
| | | Tordi Sagar |
| | | Udai Sagar |
| | | Ummed Sagar |
| | | Vallabh Nagar |
| | | Wagan |
| 8 | Chambal Basin | Bilas |
| | | Dugari |
| | | Galwania |
| | | Gopalpura |
| 9 | Mahi Basin | Jaisamand |
| | | Jakham |
| | | Mahi |
| | | Somkagdar |
| 10 | Sabarmati Basin | Nil |
| 11 | Luni Basin | Sardarsamand |
| 12 | West Banas | Nil |
| 13 | Sukli Basin | Nil |
| 14 | Other Nallah | Nil |
| 15 | Ghaggar Basin | Nil |
| 16 | Out Side Basin | Nil |

### 9.1.1 Surface Water Availability

Surface water availability for the identified projects has been taken from Final Report No. 4.3 (of this study) on Detailed Study on Catchment Areas, which has been calculated using SWAT Model at 25%, 50%, 75% and 90% climatic dependability levels.

Net availability of surface water for irrigation was computed by taking into account siltation of dams, seepage and evaporation losses, and deducting the projected amounts of water required to be supplied from the project's reservoir for domestic and industrial consumption. The availability of irrigation water on-farm was calculated on the basis of assumed conveyance efficiency values.

### 9.1.2 Groundwater Availability

In addition to surface water, groundwater availability (natural replenishment) within the command area of every irrigation project was also assessed, as well as the amounts of return flow from irrigation and domestic water utilization, and these amounts were also taken into account as available for irrigation, after allowing for domestic, livestock and other groundwater requirement within the gross command area (GCA). In irrigation projects overlying highly saline aquifers, groundwater was not considered as utilizable for irrigation.

Thus, conjunctive use of surface and ground water was considered in all the projects as a basis for the economic analysis of project improvement plans. However, a distinction was made between groundwater in projects located above alluvial aquifers, and others, considering that in the first case more aquifer storage is available for compensating the lack of surface water in lean years. In such a case of course the combined surface and

groundwater supply to irrigation is more reliable than in the case of relatively small aquifer storage, and even more so compared to surface water supply alone.

In addition to the obvious advantages of conjunctive use of surface and ground water, the Consultants consider groundwater withdrawal within surface water irrigation projects also as a necessity, to counter the danger of water logging due to irrigation return flows. This danger is most acute in areas where at present groundwater levels are high and rising, but should be taken into consideration for long term planning in any irrigation project.

## 9.2 Identification of the rehabilitation works required – project wise

For the purpose of analyzing the economic feasibility of introducing improvement in the existing irrigation projects selected for detailed analysis, the consultant have reviewed the results of already rehabilitated project under RWSRP and conservatively assumed that the following efficiencies can be attained.

1. Off farm conveyance efficiencies in existing projects after improvement are 72% for selective lining and 75% for complete lining.
2. On farm efficiency is set on 70%. The percolation losses and evaporation losses are 25% and 5% respectively.

In view of the present low water use efficiencies in existing irrigation system, improvement and modernization work are analyzed in detail for the selected 35 existing projects. The detailed note of all these projects considered as required for rehabilitation are as follows. The project related project planning worksheets are given in Annex 4.

### *9.2.1 Arwar Project*

**1. Introduction**

Arwar irrigation project has been constructed on Mansi River which joins Khari River a tributary of Banas River. The dam and reservoir are situated near village Arwar of Shahpura Tehsil in Bhilwara district. Construction of dam and Canal was completed in 1957.

**2. Important Features**

**(a) Catchment**

(i) Gross 1,145 $km^2$

(ii) Free 580 $km^2$

**(b) Design mean yield** 35.74 $Mm^3$

**(c) Command Area**

(i) GCA 13,570 ha

(ii) CCA 7,394 ha

(iii) Annual Irrigation

As Planned (Rabi only) 5,463 ha

**(d) Storage Capacity**

(i) Gross 47.91 $Mm^3$

(ii) Live 47.80 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 27.89 | 0.70 | 5.00 | 9.00 | 45.30 |

**B. Effective Live storage capacity**

The dam was commissioned in 1957 and due to siltation its effective storage capacity is likely to be reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and the effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.08 $Mm^3$ per year for 580 $km^2$, $Mm^3$/yr | 4.02 | 4.78 | 6.30 | 7.82 |
| Effective Live Storage Capacity, $Mm^3$/yr | 43.99 | 43.23 | 41.71 | 40.19 |

Since the live capacity in 2060 is nearly more than the mean yield, the siltation in dam will have no adverse effect on the availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon in 2010 which was 16.98 $Mm^3$ and 15.26 $Mm^3$ during the time of delivery. For irrigation the crop water required for 3,905 ha is 4.28 $Mm^3$ and therefore the overall irrigation efficiency worked out to 28.03% ~28%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic, (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.44 | 0.89 | 1.10 | 1.23 |
| Live Stock | 0.39 | 0.41 | 0.44 | 0.47 |
| Total | 0.83 | 1.30 | 1.54 | 1.70 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Shahpura Block) is 2.43 $Mm^3$. The average yield of water per well in potential zone is 32,310 $m^3$/yr and number of wells in the command area is 1,221.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.48 | 1.71 | 1.44 | 1.26 |
| 75% | 4.49 | 3.14 | 2.88 | 2.70 |
| 50% | 6.36 | 4.48 | 4.21 | 4.03 |
| 25% | 22.70 | 15.90 | 15.13 | 14.45 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% and 25% dependability are 45 mm and 218 mm respectively. With this amount of water land preparation is only possible at 50% dependability and two irrigations can be supplied on an average to entire CCA at 25% dependability.

Thus, under present conditions of water only deficit irrigation can be sustained, including groundwater. However, as can be seen in planning Worksheet the total annual depth of water available for irrigation can be in the area of 131 mm at 50% dependability, which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.4.)

## Cost

**A. Capital cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,138 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs 82.35 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 245.56%. Hence, no new wells recommended in this project command area.

**(iii)Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.48 per $m^3$ considering H = 51.67 m. (see Section 6 of Annex 1)

## Conclusions

The benefit/cost ratio resulting from the analysis of the proposed improvements in Arwar irrigation project is 2.38, which reflects the positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.66.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 80.81 | 97.19 | 72.97 | 112.49 | 84.20 | 128.28 | 95.79 |

According to the project's set of prioritization indicators and considerations it is ranked as number 10 (of 35) according the economic prioritization approach and 6 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.2 Badgaon Project*

**1. Introduction**

Badgaon irrigation project has been constructed on Berach River which joins Banas River. The dam and reservoir is situated near village Badgaon of Vallabh nagar Tehsil in Udaipur district. Construction of dam and Canal was completed in 1966.

**2. Important Features**

**(a) Catchment**

(i) Gross 1,699 $km^2$

(ii) Free 398.22 $km^2$

**(b) Design mean yield** 50.77 $Mm^3$

**(c) Command Area**

(i) GCA 7,244 ha

(ii) CCA 6,797 ha

(iii) Annual Irrigation

As Planned (Rabi only) 3440 ha

**(d) Storage Capacity**

(i) Gross 31.52 $Mm^3$

(ii) Live 30.19 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Results, $Mm^3$/yr (Ref. Report 4.3) | 25.30 | 0.20 | 1.00 | 3.80 | 12.10 |

**B. Effective Live storage capacity**

The dam was commissioned in 1966 and due to siltation its effective storage capacity is likely to reduce taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as detailed here under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.08 $Mm^3$ per Year for 398.22 $km^2$, $Mm^3$/yr | 2.30 | 2.82 | 3.87 | 4.91 |
| Effective Live Storage Capacity, $Mm^3$/yr | 28.93 | 28.64 | 27.66 | 26.62 |

Since the live capacity in 2060 is much more than 50% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon in 2010 which was 8.99 $Mm^3$ and 7.62 $Mm^3$ during the time of delivery. For irrigation the crop water required for 1,625 ha is 1.96 $Mm^3$ and therefore the overall irrigation efficiency worked out to 25.85%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic, (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.34 | 0.69 | 0.83 | 0.93 |
| Livestock | 0.28 | 0.30 | 0.34 | 0.38 |
| Total | 0.62 | 0.99 | 1.17 | 1.31 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in the command area worked out on proportion basis of geographical area to command area and relevant potential zone (Mavli & Kapasan Block) is 1.94 $Mm^3$/year. The average yield of water per well in potential zone is 16299 $m^3$/yr and number of well in the command area is 1274.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.87 | 1.30 | 1.10 | 0.94 |
| 75% | 2.25 | 1.56 | 1.36 | 1.21 |
| 50% | 3.60 | 2.50 | 2.30 | 2.14 |
| 25% | 7.60 | 5.27 | 5.07 | 4.91 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 25 mm. with this amount of water even land preparation will not be possible.

Thus, under present conditions of water only deficit irrigation can be sustained, including groundwater, however, as shown in planning Worksheet, the total annual depth of water available for irrigation can be about 78 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.5.)

## Cost

### A. Capital cost

### (i) Surface water

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 10,353 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs 70.37 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

### (ii) Ground water

The stage of groundwater development in the project command area is 217.85%. Hence, no new wells recommended in this project command area.

### (iii) Annual O & M cost

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.57 per $m^3$ considering H = 61.82 m. (see Section 6 of Annex 1)

## Conclusions

The benefit/cost ratio resulting from the analysis of the proposed improvements in Badgaon irrigation project is 0.95, which reflects the significant negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs.1.52.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 30.65 | 33.75 | 27.12 | 36.96 | 29.51 | 41.42 | 32.91 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 27 (of 35) according the economic prioritization approach and 29 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.3 Bagolia Project*

**1. Introduction**

Bagolia irrigation project has been constructed on Berach River which joins Banas River. The dam and reservoir are situated near village Badiya of Mavli Tehsil in Udaipur district. Construction of dam and Canal was completed in 1956.

**2. Important Features**

**(a) Catchment**

(i) Gross 257.42 $km^2$

(ii) Free 246 $km^2$

**(b) Design mean yield –** 12.50 $Mm^3$

**(c) Command Area**

(i) GCA 3,854 ha

(ii) CCA 3,676 ha

(iii) Annual Irrigation As Planned 1,963 ha

**(d) Storage Capacity**

(i) Gross 19.42 $Mm^3$

(ii) Live 18.85 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 1.25 | 0.00 | 0.00 | 0.20 | 1.11 |

**B. Effective Live storage capacity**

The dam was commissioned in 1956 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Volume at 0.03 $Mm^3$ per Year for 246 $km^2$, $Mm^3$/yr | 1.82 | 2.16 | 2.83 | 3.51 |
| Effective Live Storage Capacity, $Mm^3$/yr | 17.68 | 17.36 | 16.71 | 16.07 |

Since the live capacity in 2060 is much more than 50% dependable yield, siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation performed. The overall irrigation efficiency is worked out to 11.64%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic, (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.23 | 0.49 | 0.62 | 0.72 |
| Live stock | 0.19 | 0.20 | 0.22 | 0.25 |
| Total | 0.42 | 0.69 | 0.84 | 0.97 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Mavli & Kapasan Block) is 1.06 $Mm^3$/year. The average yield of water per well in potential zone is 9120 $m^3$/yr and number of well in the command area is 530.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.87 | 0.51 | 0.34 | 0.20 |
| 75% | 0.87 | 0.51 | 0.34 | 0.20 |
| 50% | 0.98 | 0.57 | 0.41 | 0.27 |
| 25% | 1.51 | 0.88 | 0.71 | 0.57 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 1.00 mm and with this amount of water even land preparation will not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater, however, as can be seen in planning Worksheet, the total annual depth of water available for irrigation can be about 28 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.6.)

**Cost**

**A. Capital cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,285 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs 41.48 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 207.53%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.55 per $m^3$ considering H = 59.19 m. (see Section 6 of Annex 1)

**Conclusions**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Bagolia irrigation project is 0.29. This reflects a negative difference between the with-plan and without-plan situations, in terms of crop intensities and benefits in net terms, and therefore reflects a non viable project in economic terms. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 5.44.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 6.10 | 5.22 | 4.24 | 4.86 | 3.80 | 4.55 | 3.39 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 34 (of 35) according the economic prioritization approach and 33 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.4 Bassi Project*

**1. Introduction**

Bassi irrigation project has been constructed on Local Drain which is a tributary of Banas River. The dam and reservoir are situated near village Bassi of Chittaurgarh Tehsil in Chittaurgarh district. Construction of dam and Canal was completed in 1986.

**2. Important Features**

**(a) Catchment**

(i) Gross 453 $km^2$

(ii) Free 122 $km^2$

**(b) Design mean yield** 21.96 $Mm^3$

**(c) Command Area**

(i) GCA 5,899 ha

(ii) CCA 3,250 ha

(iii) Annual Irrigation 3969 ha (54% in Rabi & 43.5% in Kharif)

**(d) Storage Capacity**

(i) Gross 23.20 $Mm^3$

(ii) Live 20.25 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 56.44 | 1.80 | 13.20 | 37.40 | 79.70 |

**B. Effective Live storage capacity**

The dam was commissioned in 1986 and due to siltation its effective storage capacity is likely to reduce, taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.02 $Mm^3$ per Year for 122 $km^2$, $Mm^3$/yr | 0.41 | 0.58 | 0.91 | 1.25 |
| Effective Live Storage Capacity, $Mm^3$/yr | 20.07 | 19.98 | 19.81 | 19.63 |

Since the live capacity in 2060 is much more than 75% dependable yield the siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon in year 2005 which was 22.0 $Mm^3$ and 18.68 $Mm^3$ during the time of delivery. For irrigation the crop water required for 1,120 ha is 2.78 $Mm^3$ and therefore the overall irrigation efficiency worked out to14.89% say 15%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.18 | 0.37 | 0.44 | 0.49 |
| Livestock | 0.18 | 0.19 | 0.21 | 0.23 |

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Total | 0.36 | 0.56 | 0.65 | 0.72 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Begun, Chittor, and Gangar Block) is 1.70 $Mm^3$/year. The average yield of water per well in potential zone is 18,900 $m^3$/yr and number of well in the command area is 730.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.75 | 2.01 | 1.91 | 1.83 |
| 75% | 8.92 | 5.74 | 5.64 | 5.56 |
| 50% | 12.63 | 7.96 | 7.80 | 7.66 |
| 25% | 12.63 | 7.96 | 7.80 | 7.66 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 148.00 mm. With this amount of water two irrigation can be supplied on an average to entire CCA.

Thus, under present conditions of water only deficit irrigation can be sustained, including groundwater, however, as can be seen in planning Worksheet, the total annual depth of water available for irrigation can be about 536 mm at 50% dependability, which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.10.)

## Cost

**A. Capital cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,100 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs 29.58 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 112.08%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.47 per $m^3$ considering H = 51.02 m. (see Section 6 of Annex 1)

## Conclusions

The benefit/cost ratio resulting from the analysis of the proposed improvements in Bassi irrigation project is 3.86, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.40.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 52.52 | 71.30 | 53.00 | 83.41 | 61.32 | 94.22 | 68.77 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 2 (of 35) according the economic prioritization approach and 3 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.5 Bhupal Sagar Project*

**1. Introduction**

Bhupal Sagar irrigation project has been constructed on Local Drain which joins Berach a tributary of Banas River. The dam and reservoir are situated near village Bhupal Sagar of Kapasan Tehsil in Chittaurgarh district. Construction of dam and Canal was completed in 1936.

**2. Important Features**

**(a) Catchment**

(i) Gross 215 $km^2$

(ii) Free 176.4 $km^2$

**(b) Design mean yield** 12.05 $Mm^3$

**(c) Command Area**

(i) GCA 4,401 ha

(ii) CCA 3,873 ha

**(d) Storage Capacity**

(i) Gross 18.54 $Mm^3$

(ii) Live 18.4 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability, $Mm^3$/yr | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result (Ref. Report 4.3) | 9.38 | 0.10 | 1.00 | 4.40 | 7.60 |

**B. Effective Live storage capacity**

The dam was commissioned in 1936 and due to siltation its effective storage capacity is likely to reduce taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at .02 $Mm^3$ per Year for176.4 $km^2$, $Mm^3$/yr | 1.48 | 1.71 | 2.17 | 2.64 |
| Effective Live Storage Capacity, $Mm^3$/yr | 16.83 | 16.60 | 16.14 | 15.64 |

Since the live capacity in 2060 is much more than 75% dependable yield, the siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability for irrigation from storage in reservoir and area irrigation done the overall irrigation efficiency worked out to be 37.51%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic, (inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.16 | 0.33 | 0.39 | 0.43 |
| Livestock | 0.12 | 0.12 | 0.14 | 0.16 |
| Total | 0.28 | 0.45 | 0.53 | 0.59 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Kapasan Block) is 1.31 $Mm^3$/yr. The average yield of water per well in potential zone is 18,240 $m^3$/yr and number of well in the command area is 202. The stage of groundwater development in the project command area is 75.15%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.41 | 1.11 | 1.02 | 0.95 |
| 75% | 1.77 | 1.41 | 1.32 | 1.25 |
| 50% | 3.15 | 2.54 | 2.45 | 2.39 |
| 25% | 3.68 | 3.61 | 3.52 | 3.45 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 53 mm. With this amount of water one irrigation can be supplied on an average to entire CCA.

Thus, under present conditions of water, only deficit irrigation can be sustained, including groundwater, however, as can be seen in planning Worksheet, the total annual depth of water available for irrigation can be about 134 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as Land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.16.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 13,661 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs 52.91 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

No new wells recommended in this project command area as existing wells are sufficient to withdraw the available (utilizable) groundwater potential.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.50 per $m^3$ considering H = 53.78 m. (see Section 6 of Annex 1)

## Conclusions

The benefit/cost ratio resulting from the analysis of the proposed improvements in Bhupalsagar irrigation project is 0.93, which reflects a negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non-viable project in economic terms. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs.1.32.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 21.36 | 26.66 | 21.62 | 30.79 | 25.08 | 33.92 | 27.72 |

According to the project's set of prioritization indicators and considerations it is ranked as number 31 (of 35) according the economic prioritization approach and 32 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.6 Bilas Irrigation Project*

**1. Introduction**

Bilas irrigation project has been constructed on Bilas River which joins Parbati River which is a tributary of Chambal River. The dam and reservoir are situated near village Bhagwangarh of Kishanganj Tehsil in Baran district. Construction of dam and Canal was completed in 1995.

**2. Important Features**

**(a) Catchment**

(i) Gross 223 $km^2$

(ii) Free 146.5 $km^2$

**(b) Command Area**

(i) GCA 6,390 ha

(ii) CCA 5,863 ha

**(c) Storage Capacity**

(i) Gross 28.88 $Mm^3$

(ii) Live 26.76 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 79.97 | 37.45 | 49.61 | 73.03 | 90.21 |

**B. Effective Live storage capacity**

The dam was commissioned in 1995 and due to siltation its effective storage capacity is likely to reduce taking siltation at rate of 0.0218 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.04 $Mm^3$ per year for196 $km^2$, $Mm^3$/yr | 0.64 | 1.07 | 1.92 | 2.78 |
| Effective Live Storage Capacity, $Mm^3$/yr | 26.60 | 26.42 | 26.07 | 25.72 |

Since the live capacity in 2060 is much more than 75% dependable yield, the siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 33.41%.

**D. Non-Agriculture demand**

There is no domestic and industrial demand for cities and towns linked with reservoir. The entire surface water is being used for irrigation. However, the rural domestic (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.20 | 0.40 | 0.48 | 0.52 |
| Livestock | 0.17 | 0.18 | 0.19 | 0.21 |
| Total | 0.37 | 0.58 | 0.67 | 0.73 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Baran Block) is 3.09 $Mm^3$/year. The average yield of water per well in potential zone is 92,610 $m^3$/yr and number of wells in the command area is 311.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 15.05 | 11.87 | 11.65 | 11.47 |
| 75% | 15.05 | 11.87 | 11.65 | 11.47 |
| 50% | 15.05 | 11.87 | 11.65 | 11.47 |
| 25% | 15.05 | 11.87 | 11.65 | 11.47 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 275 mm. with this amount of water two watering can be supplied to entire command area.

Thus, under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total

annual depth of water available for irrigation can be about 532 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.17.)

## Cost

### A. Capital cost

#### (i) Surface water

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 8,400 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 49.25 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

#### (ii) Ground water

The stage of groundwater development in the project command area is 138.33%. Hence, no new wells recommended in this project command area.

#### (iii) Annual O & M

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.49 per $m^3$ considering H = 53.37 m. (see Section 6 of Annex 1).

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Bilas irrigation project is 2.34, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.38.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 127.12 | 152.45 | 134.62 | 173.31 | 150.63 | 188.04 | 159.91 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 3 (of 35) according the economic prioritization approach and 7 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.7 Chandra Bhaga Irrigation Project*

**1. Introduction**

Chandra Bhaga irrigation project has been constructed on across river Chandra Bhaga which is tributary of Banas River. The dam and reservoir are situated near village Phunkia of Railmagra Tehsil in Rajsamand district. Construction of dam and Canal was completed in 1957.

**2. Important Features**

**(a) Catchment**

(i) Gross 384 $km^2$

(ii) Free 132 $km^2$

**(b) Design mean yield** 12.74

**(c) Command Area**

(i) GCA 6,880 ha

(ii) CCA 3,342 ha

(iii) Annual Irrigation 1,128 ha

**(d) Storage Capacity**

(i) Gross 9.97 $Mm^3$

(ii) Live 9.85 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result ($Mm^3$/Years) , $Mm^3$/yr (Ref. Report 4.3) | 9.59 | 0.10 | 0.40 | 2.90 | 12.60 |

**B. Effective Live storage capacity**

The dam was commissioned in 1957 and due to siltation its effective storage capacity is likely to reduce taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.02 $Mm^3$ per Year for 132 $km^2$, $Mm^3$/yr | 0.80 | 1.02 | 1.32 | 1.66 |
| Effective Live Storage Capacity, $Mm^3$/yr | 9.05 | 8.80 | 8.53 | 8.19 |

Since the live capacity in 2060 is much more than 75% dependable yield the siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon irrigation done and overall efficiency is worked out to 9%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic, (inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.13 | 0.27 | 0.34 | 0.37 |
| Livestock | 0.13 | 0.14 | 0.15 | 0.17 |
| Total | 0.26 | 0.41 | 0.49 | 0.54 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Sahara Railmagra Block) is 0.45 $Mm^3$/year. The average yield of water per well in potential zone is 10,680 $m^3$/yr and number of wells in the command area is 657.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.33 | 0.12 | 0.04 | 0.00 |
| 75% | 0.50 | 0.22 | 0.14 | 0.09 |
| 50% | 1.98 | 1.05 | 0.97 | 0.93 |
| 25% | 5.61 | 3.05 | 2.85 | 2.69 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 43 mm and with this amount of water even land preparation water requirement will not be possible.

Thus, under present conditions of water, only deficit irrigation can be sustained, including groundwater, however, as can be seen in planning Worksheet, the total annual depth of water available for irrigation can be about 59 mm at 50% dependability, which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.23.)

**Cost**

**A. Capital cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,285 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 37.71 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 207.15%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per KW, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.52 per $m^3$ considering H = 56.12 m. (see Section 6 of Annex 1).

**Conclusions:**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Chandra Bhaga irrigation project is 1.65, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 1.29.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 14.30 | 19.08 | 12.54 | 21.82 | 14.22 | 24.62 | 16.02 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 26 (of 35) according the economic prioritization approach and 30 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.8 Chandsen Project*

**1. Introduction**

Chandsen irrigation project has been constructed on Dhunaka Nala which joins Banas River. The dam and reservoir are situated near village Dhuan Bari of Malpura Tehsil in Tonk district. Construction of dam and Canal was completed in 1880 (Probably).

**2. Important Features**

**(a) Catchment**

(i) Gross 155.4 $km^2$

(ii) Free 74 $km^2$

**(b) Design mean yield** NA

**(c) Command Area**

(i) GCA 3,990 ha

(ii) CCA 2,600 ha

(iii) Annual Irrigation

As Planned 2,104 ha

**(d) Storage Capacity**

(i) Gross 14.70 $Mm^3$

(ii) Live 14.55 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 20.73 | 0.30 | 0.70 | 11.20 | 36.00 |

The yield based on SWAT model indicates that the reservoir has filled at 75% dependability even less then gross storage capacity therefore the aspect increasing the capacity of reservoir is being not considered.

**B. Effective Live storage capacity**

The dam was commissioned in 1880 and due to siltation its effective storage capacity is likely to reduce taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.01 $Mm^3$ per Year for 74 $km^2$, $Mm^3$/yr | 1.26 | 1.36 | 1.55 | 1.74 |
| Effective Live Storage Capacity, $Mm^3$/yr | 13.43 | 13.33 | 13.14 | 12.95 |

Since the live capacity in 2060 is much more than 75% dependable yield, the siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon in year 2010 and irrigation done 2,597 ha and overall efficiency is worked out to 26.85%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.10 | 0.20 | 0.24 | 0.27 |
| Live Stock | 0.08 | 0.08 | 0.09 | 0.10 |
| Total | 0.18 | 0.28 | 0.33 | 0.37 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Malpura Block) is 1.25 $Mm^3/yr$. The average yield of water per well in potential zone is 36,000 $m^3/yr$ and number of wells in the command area is 113. The stage of groundwater development in the project command area is 59.66%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.54 | 1.29 | 1.23 | 1.19 |
| 75% | 1.73 | 1.41 | 1.36 | 1.31 |
| 50% | 4.08 | 4.49 | 4.49 | 4.49 |
| 25% | 4.08 | 4.49 | 4.49 | 4.49 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 184 mm and with this amount of water two irrigation can be possible on an average to entire command area.

Thus, under present conditions of water, only deficit irrigation can be sustained, including groundwater, however, as can be seen in planning Worksheet, the total annual depth of water available for irrigation can be about 341 mm at 50% dependability, which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow for which 12 additional wells in the project command area would be needed over the next 10 years, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.24.)

**Cost**

**A. Capital cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 16,744 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 43.53 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The average depth to basement in project command area is 90 m (based on Final Report No. 4.4 of this study). Considering the depth of well as 72 m (80% of depth to basement), the cost of one well works out to Rs. 54,944 and the total cost of wells works out to Rs. 0.66 million. (see section 4.2 of Annex 1)

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.50 per $m^3$ considering H = 54.41 m. (see Section 6 of Annex 1)

**Conclusions:**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Chandsain irrigation project is 1.93, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.85.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 29.52 | 42.84 | 33.20 | 48.28 | 37.22 | 53.92 | 41.61 |

According to the project's set of prioritization indicators and considerations it is ranked as number 25 (of 35) according the economic prioritization approach and 26 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.9 Chaparwara Project*

**1. Introduction**

Chaparwara irrigation project has been constructed on Local drain which joins Mashi a tributary of Banas River. The dam and reservoir are situated near Dudu Tehsil town in Jaipur district. Construction of dam and Canal was completed in 1894.

**2. Important Features**

**(a) Catchment**

(i) Gross 834 $km^2$

(ii) Free 749 $km^2$

**(b) Design mean yield** 79.06 $Mm^3$

**(c) Command Area**

(i) GCA 19,218 ha

(ii) CCA 11,745 ha

**(d) Storage Capacity**

(i) Gross 53.20 $Mm^3$

(ii) Live 53.20 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 31.51 | 0.00 | 0.30 | 3.30 | 37.30 |

**B. Effective Live storage capacity**

The dam was commissioned in 1894 and due to siltation its effective storage capacity is likely to reduce taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at .01 $Mm^3$ per year for 749 $km^2$, $Mm^3$/yr | 11.38 | 12.36 | 14.32 | 16.26 |
| Effective Live Storage Capacity, $Mm^3$/yr | 41.82 | 40.84 | 38.88 | 36.92 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability for irrigation from storage in reservoir and area irrigation done the overall irrigation efficiency worked out to found 44%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.81 | 1.46 | 1.81 | 2.02 |
| Live Stock | 0.30 | 0.32 | 0.37 | 0.42 |

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Total | 1.11 | 1.78 | 2.18 | 2.42 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area and relevant potential zone (Dudu Block) is 2.73 $Mm^3$/year. The average yield of water per well in potential zone is 20,196 $m^3$/yr and number of wells in the command area is 1120.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.21 | 1.30 | 0.86 | 0.57 |
| 75% | 2.31 | 1.41 | 0.96 | 0.67 |
| 50% | 3.39 | 2.44 | 2.00 | 1.71 |
| 25% | 15.56 | 14.15 | 13.77 | 13.30 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 20 mm and with this amount of water even land preparation will not be possible.

Thus, under present conditions of water, only deficit irrigation can be sustained, including groundwater, however, as can be seen in planning Worksheet, the total annual depth of water available for irrigation can be about 49 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.25.)

## Cost

**A. Capital cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 14,370 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 168.78 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 97.13%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.49 per $m^3$ considering H = 52.83 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Chaparwara irrigation project is 0.78, which reflects a negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non viable project in economic terms. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 1.54.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 72.81 | 83.09 | 70.13 | 104.54 | 87.87 | 125.20 | 104.95 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 32 (of 35) according the economic prioritization approach and 28 (of 35) in the social prioritization approach (as described in section 10).

### 9.2.10 *Dheel Irrigation Project*

**1. Introduction**

Dheel irrigation project has been constructed on Dheel River, which joins Banas River. The dam and reservoir are situated near village Sislov of Bonli Tehsil in Sawai Madhopur district. Construction of dam and Canal was completed in 1911.

**2. Important Features**

**(a) Catchment**

(i) Gross 785 $km^2$

(ii) Free 689 $km^2$

**(b) Design mean yield** 28.81 $Mm^3$

**(c) Command Area**

(i) GCA 6,640 ha

(ii) CCA 5,943 ha

(iii) Annual Irrigation

As Planned (Rabi only) 3,350 ha

**(d) Storage Capacity**

(i) Gross 27.73 $Mm^3$

(ii) Live 27.73 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 48.10 | 0.40 | 2.50 | 20.00 | 73.80 |

**B. Effective Live storage capacity**

The dam was commissioned in 1911and due to siltation its effective storage capacity is likely to reduce, taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.09$Mm^3$ per year for 689 $km^2$, $Mm^3$/yr | 8.94 | 9.84 | 11.65 | 13.45 |
| Effective Live Storage Capacity, $Mm^3$/yr | 18.79 | 17.89 | 16.08 | 14.28 |

Since the live capacity in 2060 is nearly more than 75% dependable yield, the siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon and irrigation done. The overall irrigation efficiency worked out to 32.99%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However, the rural domestic (Inclusive of institutional and other demands) and livestock of the command area are proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.32 | 0.65 | 0.83 | 0.90 |
| Live Stock | 0.10 | 0.11 | 0.12 | 0.14 |
| Total | 0.42 | 0.76 | 0.95 | 1.04 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basis of geographical area to command area, and relevant potential zone (Sawai Madhopur & Bonli Block) is 1.61 $Mm^3$. The average yield of water per well in potential zone is 14,703 $m^3$/yr and number of wells in the command area is 710.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.76 | 1.23 | 1.01 | 0.91 |
| 75% | 2.69 | 1.94 | 1.73 | 1.63 |
| 50% | 9.91 | 7.17 | 6.35 | 5.63 |
| 25% | 9.91 | 7.17 | 6.35 | 5.63 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 179 mm. With this amount of water one or two irrigation can be supplied on an average to entire CCA.

Thus, under present conditions of water, only deficit irrigation can be sustained, including groundwater, however, as can be seen in planning Worksheet, the total annual depth of water available for irrigation can be about 339 mm at 50% dependability, which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size introduction of modern irrigation methods and introduction of impermeable conduits. (Also refer Section 5.29.)

## Cost

**A. Capital cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 14,600 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 86.77 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 153.13%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.54 per $m^3$ considering H = 58.25 m. (see Section 6 of Annex 1)

**Conclusions:**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Dheel irrigation project is 1.25, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 1.00.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 62.01 | 71.03 | 58.99 | 67.43 | 55.92 | 66.76 | 55.35 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 28 (of 35) according the economic prioritization approach and 24 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.11 Dindoli Irrigation Project*

**1. Introduction**

Dindoli irrigation project has been constructed on local nala in Berach Sub-basin of Banas basin. The dam and reservoir are situated near village Dindoli of Rashmi Tehsil in Chittaurgarh, the catchment of dam is small as compared to Dam capacity. Later on to augment the water supply to reservoir a feeder taking off from a weir near Gilundi village was constructed in 1965.

**2. Important Features**

**(a) Catchment**

(i) Gross 21.00 $km^2$

(ii) Free 20.72 $km^2$

**(b) Design mean yield** 1.86 $Mm^3$

**(c) Command Area**

(i) GCA 2,333 ha

(ii) CCA 2,056 ha

**(d) Storage Capacity**

(i) Gross 7.52 $Mm^3$

(ii) Live 7.45 $Mm^3$

**Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water at Dam.**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3/yr$ (Ref. Report 4.3) | 3.09 | 0.20 | 0.80 | 2.40 | 3.60 |

**B. Diversion from Gilundi Village Weir**

To overcome the storage of water, water diverted by feeder from Weir situated at Gilundi village, hence water available at 90%, 75%, 50% and 25% dependability are 1.20, 2.66, 4.81, 6.28 $Mm^3$ respectively.

The yield base on SWAT model indicates that the reservoir has filled but 75% dependability even less the gross storage capacity therefore the aspect increasing the capacity of reservoir is being not considered.

**C. Effective Live storage capacity**

The dam was commissioned in 1965 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of .0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.01 $Mm^3$ per year for 20.72$km^2$, $Mm^3/yr$ | 0.13 | 0.16 | 0.21 | 0.27 |
| Effective Live Storage Capacity, $Mm^3/yr$ | 7.39 | 7.36 | 7.31 | 7.25 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**D.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon and irrigation done the canal overall efficiency worked out to 13%.

**E. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.10 | 0.21 | 0.26 | 0.28 |
| Live Stock | 0.11 | 0.12 | 0.14 | 0.15 |
| Total | 0.21 | 0.33 | 0.40 | 0.43 |

**F. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Kapasan and Rashmi Block) is 0.56 $Mm^3/yr$. The average yield of water per well in potential zone is 16,380 $m^3/yr$ and number of well in the command area is 373.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.24 | 0.75 | 0.67 | 0.64 |
| 75% | 2.41 | 1.44 | 1.36 | 1.33 |
| 50% | 4.53 | 2.69 | 2.61 | 2.58 |
| 25% | 4.53 | 2.74 | 2.64 | 2.59 |

**G. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 176mm with this amount of water upto one irrigation can be supplied on an average to entire CCA.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 396 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size Introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.30.)

## Cost

**A. Capital of Cost**

**(i) Surface Water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 10,486 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 21.56 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground Water**

The stage of groundwater development in the project command area is 172.94%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M Cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh. The cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.61 per $m^3$ considering H = 66.13 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Dindoli irrigation project is 2.96, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms

and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.64.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 18.98 | 27.32 | 18.91 | 31.51 | 21.70 | 34.80 | 23.91 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 15 (of 35) according the economic prioritization approach and 20 (of 35) in the social prioritization approach (as described in section 10).

### 9.2.12 *Dugari Irrigation Project*

**1. Introduction**

Dugari irrigation project has been construction on Local drain which joins Mej River which is a tributary of Chambal River. The dam and reservoir are situated near village Dugari of Nainwa Tehsil in Bundi district Construction of dam and Canal was completed in 1955.

**2. Important Features**

**(a) Catchment**

(i) Gross 112.60 $km^2$

(ii) Free 106.32 $km^2$

**(b) Command Area**

(i) GCA 2877 ha

(ii) CCA 2251 ha

**(c) Storage Capacity**

(i) Gross 18.08 $Mm^3$

(ii) Live 18.08 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 9.36 | 0.00 | 0.19 | 3.56 | 14.67 |

**B. Effective Live storage capacity**

The dam was commissioned in 1955 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0214 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.02 $Mm^3$ per year for 106.32 $km^2$, $Mm^3$/yr | 1.27 | 1.50 | 1.97 | 2.43 |
| Effective Live Storage Capacity, $Mm^3$/yr | 16.81 | 16.58 | 16.11 | 15.65 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 24.28%.

**D. Non-Agriculture demand**

There is 3.76 $Mm^3$ domestic demand for villages linked with reservoir remaining surface water is being used for irrigation. However the rural domestic demand of command area (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.07 | 0.14 | 0.17 | 0.18 |
| Live Stock | 0.05 | 0.05 | 0.07 | 0.07 |
| Total | 0.12 | 0.19 | 0.24 | 0.25 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Nainwa Block) is 0.68 $Mm^3$/year. The average yield of water per well in potential zone is 19,176 $m^3$/yr and number of well in the command area is 280. The stage of groundwater development in the project command area is 59.89%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.08 | 0.95 | 0.89 | 0.88 |
| 75% | 1.10 | 0.97 | 0.90 | 0.90 |
| 50% | 1.35 | 1.23 | 1.16 | 1.15 |
| 25% | 5.37 | 4.69 | 4.62 | 4.62 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is zero mm.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 60 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in additional to improving the canal system and on farm remedial measures, such as Land leveling, Adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.31.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,285 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 25.40 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

No new wells recommended in this project command area as existing wells are sufficient to withdraw the available (utilizable) groundwater potential.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.53 per $m^3$ considering H = 57.14 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Dugari irrigation project is 2.16, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.59.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 18.76 | 26.44 | 19.28 | 29.10 | 21.26 | 31.31 | 22.89 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 19 (of 35) according the economic prioritization approach and 18 (of 35) in the social prioritization approach (as described in section 10).

### 9.2.13 *Galwania Irrigation Project*

**1. Introduction**

Galwania irrigation project has been construction on Local drain jointing Chakan River, a tributaries of Chambal. The dam and reservoir are situated near village Galwania of Uniara Tehsil in Tonk district Construction of dam and Canal was completed in 1954.

**2. Important Features**

**(a) Catchment**

(i) Gross 71.60 $km^2$

(ii) Free 69.50 $km^2$

**(b) Command Area**

(i) GCA 2435 ha

(ii) CCA 2257 ha

**(c) Storage Capacity**

(i) Gross 12.51 $Mm^3$

(ii) Live 11.39 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 17.21 | 2.42 | 7.60 | 16.66 | 23.93 |

**B. Effective Live storage capacity**

The dam was commissioned in 1954 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0214 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.02 $Mm^3$ per year for 69.50 $km^2$, $Mm^3$/yr | 0.83 | 0.98 | 1.28 | 1.59 |
| Effective Live Storage Capacity, $Mm^3$/yr | 10.93 | 10.85 | 10.68 | 10.51 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage is reservoir at the end of monsoon and irrigation done. The overall irrigation efficiency worked out to14.50%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.10 | 0.19 | 0.23 | 0.26 |
| Live Stock | 0.08 | 0.08 | 0.09 | 0.10 |
| Total | 0.18 | 0.27 | 0.32 | 0.36 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Keshoraipatan, Uniara, Khandar Block) is 1.11 $Mm^3$/year. The average yield of water per well in potential zone is 23,925 $m^3$/yr and number of well in the command area is 321. The stage of groundwater development in the project command area is 78.55%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.52 | 1.81 | 1.75 | 1.71 |
| 75% | 5.28 | 3.47 | 3.41 | 3.37 |
| 50% | 7.06 | 4.51 | 4.40 | 4.30 |
| 25% | 7.06 | 4.51 | 4.40 | 4.30 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 233 mm.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 313 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as Land

leveling, Adjustment of plot size Introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.34.)

**Cost**

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 12,163 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 27.45 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

No new wells recommended in this project command area as existing wells are sufficient to withdraw the available (utilizable) groundwater potential.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.53 per $m^3$ considering H = 57.25 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Galwania irrigation project is 3.64, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.53.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 41.27 | 53.94 | 39.20 | 60.72 | 43.51 | 67.31 | 48.17 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 11 (of 35) according the economic prioritization approach and 14 (of 35) in the social prioritization approach (as described in section 10).

### 9.2.14 *Gopalpura Irrigation Project*

**1. Introduction**

Gopalpura irrigation project has been construction on Revli and Gherawali which is a tributaries of Kul River of Parbati sub basin in Chambal basin. The dam and reservoir are situated near village Gopalpura of Kisanganj Tehsil in Baran district Construction of dam and Canal was completed in 1980.

**2. Important Features**

**(a) Catchment**

(i) Gross 242 $km^2$

(ii) Free 229.22 $km^2$

**(b) Command Area**

(i) GCA 5718 ha

(ii) CCA 3557 ha

**(c) Storage Capacity**

(i) Gross 32.64 $Mm^3$

(ii) Live 32.01 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 51.42 | 16.78 | 22.04 | 44.09 | 67.36 |

**B. Effective Live storage capacity**

The dam was commissioned in 1980 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0214 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.05 $Mm^3$ per year for 229.22 $km^2$, $Mm^3$/yr | 1.47 | 1.96 | 2.94 | 3.92 |
| Effective Live Storage Capacity, $Mm^3$/yr | 31.17 | 30.67 | 29.70 | 28.72 |

**C.** The overall irrigation efficiency has been examined on the water availability from storage is reservoir at the end of monsoon and irrigation done. The overall irrigation efficiency worked out to 45.07%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.13 | 0.26 | 0.31 | 0.34 |
| Live Stock | 0.11 | 0.12 | 0.13 | 0.14 |
| Total | 0.24 | 0.38 | 0.44 | 0.48 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Baran, Kishanganj Block) is 2.39 $Mm^3$/year. The average yield of water per well in potential zone is 92,070 $m^3$/yr and number of well in the command area is 376.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 7.71 | 8.75 | 8.68 | 8.64 |
| 75% | 9.24 | 10.72 | 10.66 | 10.61 |
| 50% | 11.89 | 13.97 | 13.53 | 13.12 |
| 25% | 11.89 | 13.97 | 13.53 | 13.12 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 732 mm with this amount of water two or three watering is possible on an average to entire command area.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 1067 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.38.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,760 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 34.72 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 118.31%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.47 per $m^3$ considering H = 50.82 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Gopalpura irrigation project is 0.50, which reflects a negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.28.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 95.62 | 102.19 | 102.19 | 113.29 | 113.29 | 120.08 | 120.08 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 21 (of 35) according the economic prioritization approach and 22 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.15 Jaisamand Irrigation Project*

**1. Introduction**

Jaisamand irrigation project has been construction on across river Gomati which is tributary of Sone River in Mahi Basin. The dam and reservoir are situated about 52 km Southeast of Udaipur in Udaipur district Construction of dam and Canal was done in state time nearly in 1730.

**2. Important Features**

**(a) Catchment**

(i) Gross 1813 $km^2$

(ii) Free 1654 $km^2$

**(b) Command Area**

(i) GCA 37282 ha

(ii) CCA 16000 ha

**(c) Storage Capacity**

(i) Gross 414.6 $Mm^3$

(ii) Live 296.10 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3), $Mm^3$/yr | 176.11 | 5.00 | 18.70 | 110.00 | 245.70 |

The yield based on SWAT indicates that the reservoir has filled at 75% dependability even less then gross storage capacity therefore the aspect increasing the capacity of reservoir is being not considered.

**B. Effective Live storage capacity**

The dam was commissioned in 1730 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0350 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.58 $Mm^3$ per year for 1654 $km^2$, $Mm^3$/yr | 162.92 | 168.71 | 180.29 | 191.07 |
| Effective Live Storage Capacity, $Mm^3$/yr | 206.95 | 203.77 | 197.40 | 191.03 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon irrigation done and overall efficiency is worked out to 33.48%

**D. Non-Agriculture demand**

There is domestic demand of 17.81 $Mm^3$ for cities and towns linked with reservoir and remaining surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 1.56 | 3.28 | 4.23 | 4.79 |
| Live Stock | 1.18 | 1.24 | 1.35 | 1.47 |
| Total | 2.74 | 4.52 | 5.58 | 6.26 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Salumber & Sarda Block) is 9.87 $Mm^3$/yr. The average yield of

water per well in potential zone is 13,950 $m^3$/yr and number of well in the command area is 3519. The stage of groundwater development in the project command area is 83.45%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 10.52 | 7.78 | 6.50 | 5.63 |
| 75% | 13.27 | 10.39 | 8.80 | 7.61 |
| 50% | 92.70 | 101.30 | 99.68 | 98.45 |
| 25% | 139.94 | 178.90 | 174.60 | 170.31 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 273 mm with this amount of water one watering is possible on an average to entire command area.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 579 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow for which 442 additional wells in the project command area would be needed over the next 10 years, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.46.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 14,370 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 229.92 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The average depth to basement in project command area is 120 m (based on Final Report No. 4.4 of this study). Considering the depth of well as 96 m (80% of depth to basement), the cost of one well works out to Rs. 69,992 and the total cost of wells works out to Rs. 30.94 million. (see section 4.2 of Annex 1)

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per KW, the cost of pumping per $m^3$

of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.45 per $m^3$ considering H = 49.08 m. (see Section 6 of Annex 1)

**Conclusions:**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Jaisamand irrigation project is 1.23, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.40.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 363.39 | 374.33 | 353.54 | 429.69 | 404.52 | 485.82 | 457.77 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 17 (of 35) according the economic prioritization approach and 4 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.16 Jakham Irrigation Project*

**1. Introduction**

Jakham irrigation project has been construction on across river Jakham which is tributary of Mahi River. The dam and reservoir are situated near Dhariawad of Dhariawad Tehsil in Pratapgarh district the project comprises a straight gravity masonry dam 81 m with a pickup weir located 11 km downstream where two canals branch off for irrigating its command area. The project was completed in 1986.

**2. Important Features**

**(a) Free Catchment** 1010 $km^2$

**(b) Command Area**

(i) GCA 38901 ha

(ii) CCA 28307.92 ha

**(c) Storage Capacity**

(i) Gross 142.02 $Mm^3$

(ii) Live 132.19 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3), $Mm^3$/yr, $Mm^3$/yr | 316.92 | 40.80 | 152.40 | 303.80 | 410.80 |

The yield base on SWAT model indicates that the reservoir has filled at 75% dependability yield is little more than gross storage capacity therefore the aspect increasing the capacity of reservoir is being not considered.

**B. Effective Live storage capacity**

The dam was commissioned in 1986 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0243 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.25 $Mm^3$ per year for 1010 $km^2$, $Mm^3$/yr | 8.48 | 12.02 | 19.09 | 26.16 |
| Effective Live Storage Capacity, $Mm^3$/yr | 127.52 | 125.58 | 121.69 | 115.86 |

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon irrigation done and overall efficiency is worked out to 41.00%.

**D. Non-Agriculture demand**

There is domestic demand of 2.29 $Mm^3$ for cities and towns linked with reservoir and remaining surface water is being used for irrigation. However the rural and urban domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Urban Domestic | 0.62 | 0.63 | 0.66 | 0.80 |
| Rural Domestic | 1.33 | 2.81 | 3.67 | 4.17 |
| Live Stock | 2.16 | 2.24 | 2.41 | 2.59 |
| Total | 4.11 | 5.68 | 6.74 | 7.56 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Dhariawad, Ghatol & Pratapgarh, Peepalkhoot Block) is 4.73 $Mm^3$/year. The average yield of water per well in potential zone is 25,329 $m^3$/yr and number of well in the command area is 2257. The stage of groundwater development in the project command area is 81.39%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 17.26 | 13.63 | 12.59 | 11.78 |
| 75% | 52.19 | 43.39 | 40.99 | 38.13 |
| 50% | 52.19 | 43.39 | 40.99 | 38.13 |
| 25% | 52.19 | 43.39 | 40.99 | 38.13 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 242 mm with this amount of water one watering is possible on an average to entire command area.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 426 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.48.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 8,000 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 226.55 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

No new wells recommended in this project command area as existing wells are sufficient to withdraw the available (utilizable) groundwater potential.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.44 per $m^3$ considering H = 47.22 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Jakham irrigation project is 2.94, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.36.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 607.51 | 672.54 | 573.56 | 774.22 | 660.15 | 848.61 | 723.44 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 1 (of 35) according the economic prioritization approach and 1 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.17 Kalisil Irrigation Project*

**1. Introduction**

Kalisil irrigation project has been construction on Kalisil River which joins Banas River. The dam and reservoir are situated near town Ramthora of Sapotra Tehsil in Karauli District Construction of dam and Canal was completed in 1956.

**2. Important Features**

**(a) Catchment**

(i) Gross 331.52 $km^2$

(ii) Free 331.52 $km^2$

**(b) Command Area**

(i) GCA 4868 ha

(ii) CCA 4700 ha

**(c) Storage Capacity**

(i) Gross 41.70 $Mm^3$

(ii) Live 37.25 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 45.76 | 0.60 | 11.00 | 33.80 | 70.60 |

**B. Effective Live storage capacity**

The dam was commissioned in 1956 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.05 $Mm^3$ per year for 332 $km^2$, $Mm^3$/yr | 2.35 | 2.78 | 3.65 | 4.52 |
| Effective Live Storage Capacity, $Mm^3$/yr | 35.96 | 35.72 | 35.24 | 34.77 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 22.42%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.11 | 0.24 | 0.31 | 0.35 |
| Live Stock | 0.10 | 0.11 | 0.13 | 0.15 |
| Total | 0.21 | 0.35 | 0.44 | 0.50 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Sapotra Block) is 3.28 $Mm^3$/year. The average yield of water per well in potential zone is 63,174 $m^3$/yr and number of well in the command area is 425.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 4.32 | 3.75 | 3.66 | 3.59 |
| 75% | 9.70 | 7.32 | 7.23 | 7.16 |
| 50% | 21.44 | 15.10 | 15.01 | 14.94 |
| 25% | 22.62 | 15.80 | 15.55 | 15.31 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 249 mm with this amount of water one irrigation can be supplied on an average to entire CCA.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 705 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with

full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.56.)

## Cost

### A. Capital of cost

#### (i) Surface water

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,285 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 53.04 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

#### (ii) Ground water

The stage of groundwater development in the project command area is 167.43%. Hence, no new wells recommended in this project command area.

#### (iii) Annual O & M cost

The energy required per $m^3$ of waters pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.57 per $m^3$ considering H = 61.31 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Kalisil irrigation project is 1.21, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.44.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 149.13 | 158.66 | 152.82 | 168.46 | 162.49 | 179.56 | 173.43 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 20 (of 35) according the economic prioritization approach and 17 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.18 Khari Irrigation Project*

**1. Introduction**

Khari irrigation project has been construction on Khari River which joins Banas River. The dam and reservoir are situated near village Danda of Asind Tehsil in Bhilwara district Construction of dam and Canal was completed in 1957.

**2. Important Features**

**(a) Catchment**

(i) Gross 712 $km^2$

(ii) Free 518 $km^2$

**(b) Design mean yield** 55.46 $Mm^3$

**(c) Command Area**

(i) GCA 10121 ha

(ii) CCA 6478 ha

(iii) Annual Irrigation

As Planned 3809 ha

**(d) Storage Capacity**

(i) Gross 38.96 $Mm^3$

(ii) Live 33.30 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 24.18 | 0.90 | 3.10 | 12.00 | 37.80 |

**B. Effective Live storage capacity**

The dam was commissioned in 1957 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.7 $Mm^3$ per year for 518 $km^2$, $Mm^3$/yr | 3.56 | 4.24 | 5.60 | 6.95 |
| Effective Live Storage Capacity, $Mm^3$/yr | 31.68 | 31.31 | 30.56 | 29.81 |

Since the live capacity in 2060 is much more than 50% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 13.99% say 14%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural and urban domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Urban Domestic | 0.91 | 1.06 | 1.82 | 2.11 |
| Rural Domestic | 0.40 | 0.83 | 0.87 | 1.15 |
| Live Stock | 0.31 | 0.32 | 0.35 | 0.38 |
| Total | 1.62 | 2.21 | 3.04 | 3.64 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Asind & Hurda Block) is 1.42 $Mm^3$/year. The average yield of water per well in potential zone is 11,040 $m^3$/yr and number of well in the command area is 1993.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.57 | 0.00 | 0.00 | 0.00 |
| 75% | 1.80 | 0.58 | 0.00 | 0.00 |
| 50% | 6.77 | 3.55 | 2.85 | 2.28 |
| 25% | 17.75 | 10.00 | 9.05 | 8.22 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 43 mm with this amount of water even land preparation will not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 147 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.59.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,138 /ha which includes the cost of

improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 72.15 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 263.44%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.58 per $m^3$ considering H = 62.44 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Khari irrigation project is 2.70, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.70.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 55.98 | 73.29 | 50.14 | 80.88 | 55.99 | 91.19 | 61.15 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 9 (of 35) according the economic prioritization approach and 8 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.19 Kothari Irrigation Project*

**1. Introduction**

Kothari irrigation project has been construction on Kothari River which joins Banas River. The dam and reservoir are situated near village Nandrai of Mandalgarh Tehsil in Bhilwara district Construction of dam and Canal was completed in 1989.

**2. Important Features**

**(a) Catchment**

(i) Gross 2201 $km^2$

(ii) Free 329 $km^2$

**(b) Design mean yield** 26.65 $Mm^3$

**(c) Command Area**

(i) GCA 6120 ha

(ii) CCA 4395 ha

(iii) Annual Irrigation

As Planned 3077 ha

**(d) Storage Capacity**

(i) Gross 26.05 $Mm^3$

(ii) Live 21.52 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 57.71 | 1.10 | 7.90 | 49.80 | 106.70 |

**B. Effective Live storage capacity**

The dam was commissioned in 1989 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.05 $Mm^3$ per year for329 $km^2$, $Mm^3$/yr | 0.91 | 1.34 | 2.2 | 3.06 |
| Effective Live Storage Capacity, $Mm^3$/yr | 21.02 | 20.78 | 20.31 | 19.83 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 26.04%.

**D. Non-Agriculture demand**

There is no domestic demand for cities and towns linked with reservoir but there is industrial demand of 1.56 $Mm^3$ remaining surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.20 | 0.40 | 0.50 | 0.55 |
| Live Stock | 0.09 | 0.10 | 0.10 | 0.11 |
| Total | 0.29 | 0.50 | 0.60 | 0.66 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Kothari and Mandalgarh Block) is 1.96 $Mm^3$/year. The average yield of water per well in potential zone is 28,176 $m^3$/yr and number of well in the command area is 592.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.20 | 1.80 | 1.69 | 1.62 |
| 75% | 5.12 | 3.83 | 3.72 | 3.65 |
| 50% | 11.41 | 8.13 | 7.86 | 7.63 |
| 25% | 11.41 | 8.13 | 7.86 | 7.63 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 185 mm with this amount of water one irrigation can be supplied on an average to entire CCA.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 445 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.61.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,100 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 39.99 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 148.54%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.51 per $m^3$ considering H = 55.05 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Kothari irrigation project is 2.73, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.46.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 64.79 | 75.26 | 59.57 | 88.29 | 69.83 | 101.94 | 80.61 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 4 (of 35) according the economic prioritization approach and 10 (of 35) in the social prioritization approach (as described in section 10).

### 9.2.20 *Lassadia Irrigation Project*

**1. Introduction**

Lassadia irrigation project has been construction on Dai River which joins Banas River. The dam and reservoir are situated near village Jalkakhera of Kekri Tehsil in Ajmer district Construction of dam and Canal was completed in 1980.

**2. Important Features**

**(a) Catchment**

(i) Gross 2411 $km^2$

(ii) Free 148 $km^2$

**(b) Design mean yield** 12.74 $Mm^3$

**(c) Command Area**

(i) GCA 2320 ha

(ii) CCA 2080 ha

(iii) Annual Irrigation

As Planned 1352 ha

**(d) Storage Capacity**

(i) Gross 11.49 $Mm^3$

(ii) Live 10.65 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 23.52 | 0.00 | 4.80 | 14.70 | 34.00 |

**B. Effective Live storage capacity**

The dam was commissioned in 1980 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.02 $Mm^3$ per year for148 $km^2$, $Mm^3$/yr | 0.58 | 0.77 | 1.16 | 1.55 |
| Effective Live Storage Capacity, $Mm^3$/yr | 10.38 | 10.27 | 10.06 | 9.85 |

Since the live capacity in 2060 is much more than 50% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 11%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.07 | 0.15 | 0.19 | 0.21 |
| Live Stock | 0.09 | 0.09 | 0.10 | 0.11 |
| Total | 0.16 | 0.24 | 0.29 | 0.32 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Kekri Block) is 0.40 $Mm^3$/year. The average yield of water per well in potential zone is 28,800 $m^3$/yr and number of well in the command area is 226.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.33 | 0.21 | 0.16 | 0.13 |
| 75% | 2.99 | 1.75 | 1.70 | 1.67 |
| 50% | 6.09 | 3.51 | 3.38 | 3.28 |
| 25% | 6.09 | 3.51 | 3.38 | 3.28 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 240 mm with this amount of water two irrigation can be supplied on an average to entire area.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 533 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.62.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,760 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 20.30 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 234.43%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.47 per $m^3$ considering H = 51.25 m. (see Section 6 of Annex 1)

**Conclusions:**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Lassadia irrigation project is 3.27, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.48.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 21.42 | 30.91 | 22.44 | 39.40 | 27.89 | 46.00 | 32.71 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 8 (of 35) according the economic prioritization approach and 16 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.21 Madhosagar Irrigation Project*

**1. Introduction**

Madhosagar irrigation project has been construction on Choti River which joins Banganga River. The dam and reservoir are situated near Sikarai of Dausa Tehsil in Dausa district Construction of dam and Canal was completed in 1887.

**2. Important Features**

**(a) Catchment**

(i) Gross 75.4 $km^2$

(ii) Free 75.4 $km^2$

**(b) Command Area**

(i) GCA 5385 ha

(ii) CCA 3232 ha

**(c) Storage Capacity**

(i) Gross 22.61 $Mm^3$

(i) Live 22.50 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3/yr$ (Ref. Report 4.3) | 7.72 | 0.80 | 3.10 | 6.90 | 10.60 |

The yield based on SWAT model indicates that the reservoir has filled but 75% dependability even less than Gross Storage Capacity therefore the aspect of increasing the capacity of reservoir is not being considered.

**B. Effective Live storage capacity**

The dam was commissioned in 1887 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.01 $Mm^3$ per year for75.4 $km^2$, $Mm^3/yr$ | 1.21 | 1.31 | 1.51 | 1.70 |
| Effective Live Storage Capacity, $Mm^3/yr$ | 21.40 | 21.30 | 21.10 | 20.91 |

Since the live capacity in 2060 is much more than 50% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 5.4%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.66 | 1.29 | 1.76 | 1.99 |
| Live Stock | 0.37 | 0.41 | 0.49 | 0.58 |
| Total | 1.03 | 1.70 | 2.25 | 2.57 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Dausa Block) is 8.32 $Mm^3$/year. The average yield of water per well in potential zone is 22,740 $m^3/yr$ and number of well in the command area is 1361.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 10.40 | 8.55 | 7.94 | 7.59 |
| 75% | 11.99 | 9.42 | 8.81 | 8.45 |

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 50% | 14.65 | 10.86 | 10.25 | 9.90 |
| 25% | 17.45 | 12.38 | 11.77 | 11.42 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 128 mm with this amount of water one irrigation can be supplied on an average to entire area.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 582 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.64.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 16,724 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 54.05 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 138.20%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.76 per $m^3$ considering H = 81.73 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Madhosagar irrigation project is 1.78, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.88.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 96.75 | 105.69 | 92.83 | 133.92 | 113.57 | 159.57 | 134.64 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 24 (of 35) according the economic prioritization approach and 25 (of 35) in the social prioritization approach (as described in section 10).

### 9.2.22 *Mahi Bajaj Sagar Project*

**1. Introduction**

Mahi Bajaj Sagar Project was constructed to impound Mahi River water for use in Rajasthan & Gujarat. It is an interstate multipurpose scheme located 16 km northeast of Banswara town in Rajasthan. The project conduces a dam, a system of canals and two hydroelectric power stations one with 50 mw capacity near Banswara and another with 90 MW capacity near Lilvani village, the construction of dam canals etc was completed in 1983.

**2. Important Features**

**(a) Catchment**

(i) Gross 6149 $km^2$ (1785 $km^2$ in Rajasthan,4364 $km^2$ in Gujarat)

(ii) Free 6088 $km^2$

(iii) Estimated Annual Yield 370 $Mm^3$

**(b) Command Area**

(i) GCA 1,35000 ha

(ii) CCA 80,000 ha

**(c) Storage Capacity**

(i) Gross 2180.39 $Mm^3$

(ii) Live ` 1833.72 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

(The available water is to be shared between Rajasthan & Gujarat in 16:40 ratio.)

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result (Gujarat & Rajasthan) (Ref. Report 4.3) | 3,077.55 | 899.68 | 1,964.17 | 3,009.81 | 4,009.16 |
| Rajasthan Share | 879.30 | 257.06 | 561.20 | 859.71 | 1,145.43 |

**B. Effective Live storage capacity**

The dam was commissioned in 1983 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0350 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 2.13 $Mm^3$ per year for 6088 $km^2$ (In Live Storage) , $Mm^3$/yr | 57.53 | 78.84 | 121.45 | 164.07 |
| Effective Live Storage Capacity, $Mm^3$/yr | 1807.83 | 1796.11 | 1772.67 | 1749.23 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage is reservoir at the end of monsoon and irrigation done. The overall irrigation efficiency worked out to33.50%.

**D. Non-Agriculture demand**

There is industrial and domestic demand are 1.922 and 4.24 $Mm^3$ respectively for cities and towns linked with reservoir and remaining surface water is being used for irrigation. However the rural and urban domestic (inclusive of institutional and other demands) for Banswara, Partapur and Garhi are partly supplied by surface water of (Mahi, Surwania, Bhagora Dam) and rest of demand are supplied by Groundwater and live stock and other demands of the command area is proposed to be supplied entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Urban Domestic | 1.66 | 1.77 | 2.36 | 4.60 |
| Rural Domestic | 12.35 | 27.31 | 37.22 | 43.02 |
| Live Stock | 7.18 | 7.49 | 8.09 | 8.72 |
| Total | 21.19 | 36.57 | 47.67 | 56.34 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Banswara, Dungarpur & Pratapgarh Block) is 58.77 $Mm^3$/year. The average yield of water per well in potential zone is 28,560 $m^3$/yr and number of well in the command area is 4066. The stage of groundwater development in the project command area is 36.22%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 116.12 | 117.74 | 105.33 | 95.71 |
| 75% | 116.12 | 204.71 | 190.03 | 178.14 |
| 50% | 116.12 | 204.71 | 190.03 | 178.14 |
| 25% | 116.12 | 204.71 | 190.03 | 178.14 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 406 mm with this amount of water two or three irrigation can be supplied to entire command area.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 552 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow for which 4,836 additional wells in the project command area would be needed over the next 10 years, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.65.)

## Cost

**A. Capital of Cost**

**(i) Surface Water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 8,550 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 684.00 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground Water**

The average depth to basement in project command area is 117 m (based on Final Report No. 4.4 of this study). Considering the depth of well as 94 m (80% of depth to basement), the cost of one well works out to Rs. 68,454 and the total cost of wells works out to Rs. 331.04 million. (see section 4.2 of Annex 1)

**(iii) Annual O & M Cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.43 per $m^3$ considering H = 46.60 m. (see Section 6 of Annex 1)

## Conclusions

The benefit/cost ratio resulting from the analysis of the proposed improvements in Mahi Bajaj Sagar irrigation project is 2.14, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.40.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 1,163.70 | 2,882.70 | 2,608.59 | 3,244.58 | 2,982.69 | 3,534.04 | 3,324.79 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 13 (of 35) according the economic prioritization approach and 13 (of 35) in the social prioritization approach (as described in section 10).

### 9.2.23 *Mataji Ka Khera Irrigation Project*

**1. Introduction**

Mataji Ka Khera irrigation project has been construction on Local Drain which is a tributary of Banas River. The dam and reservoir are situated near village Mataji Ka Khera near Dariba Miner of Railmagra Tehsil in Rajsamand district Construction of dam and Canal was completed in 1958.

**2. Important Features**

**(a) Catchment**

(i) Gross 14.16 $km^2$ (Own catchment of Mataji Ka Khera)

(ii) Free 14.16 $km^2$

**(b) Design mean yield**

(i) From its own catchment 0.80 $Mm^3$

(ii) Diversion from Nand Samand 11.00 $Mm^3$

**(c) Command Area**

(i) GCA 3644 ha

(ii) CCA 3057 ha

(iii) Annual Irrigation

As Planned 2140 ha

**(d) Storage Capacity**

(i) Gross 11.90 $Mm^3$

(ii) Live 11.07 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3/yr$ (Ref. Report 4.3) | 0.97 | 0.00 | 0.20 | 0.30 | 0.80 |
| Diversion from Nandsamand, $Mm^3/yr$ | 4.44 | 0.00 | 0.00 | 3.68 | 10.59 |
| Total | 5.41 | 0.00 | 0.20 | 3.98 | 11.39 |

**B. Effective Live storage capacity**

The dam was commissioned in 1958 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.0018 $Mm^3$ per year for 14 $km^2$, $Mm^3/yr$ | 0.10 | 0.12 | 0.16 | 0.19 |
| Effective Live Storage Capacity, $Mm^3/yr$ | 11.02 | 11.01 | 10.99 | 10.97 |

Since the live capacity in 2060 is much more than 50% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 7.45%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.17 | 0.33 | 0.42 | 0.43 |
| Live Stock | 0.14 | 0.15 | 0.17 | 0.18 |
| Total | 0.31 | 0.48 | 0.59 | 0.61 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Bhopal Sagar & Railmagra Block) is 0.66 $Mm^3$/year. The average yield of water per well in potential zone is 12,840 $m^3/yr$ and number of well in the command area is 313.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.48 | 0.26 | 0.14 | 0.12 |
| 75% | 0.60 | 0.32 | 0.20 | 0.18 |
| 50% | 2.82 | 1.56 | 1.44 | 1.42 |
| 25% | 4.02 | 3.85 | 3.73 | 3.70 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 16.00mm with this amount of water even land preparation will not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 108 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.69.)

## Cost

**A. Capital of Cost**

**(i) Surface Water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,285 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 34.50 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground Water**

The stage of groundwater development in the project command area is 109.41%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M Cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.54 per $m^3$ considering H = 58.30 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Mataji ka Khera irrigation project is 3.13, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.86.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 14.54 | 27.31 | 13.61 | 31.61 | 15.74 | 36.17 | 18.03 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 18 (of 35) according the economic prioritization approach and 19 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.24 Meja Irrigation Project*

**1. Introduction**

Meja irrigation project has been construction on Kothari River which joins Banas River. The dam and reservoir are situated 16 km North-West of Bhilwara town near village Meja of Bhilwara Tehsil in Bhilwara district Construction of dam and Canal was completed in 1957.

**2. Important Features**

**(a) Catchment**

(i) Gross 1651 $km^2$

(ii) Free 1049 $km^2$

**(b) Design mean yield** 77.67 $Mm^3$

**(c) Command Area**

(i) GCA 25910 ha

(ii) CCA 20714 ha

(iii) Annual Irrigation

As Planned 9308 ha

**(d) Storage Capacity**

(i) Gross 84.00 $Mm^3$

(ii) Live 83.55 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water from own catchment**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 8.66 | 0.00 | 0.00 | 2.10 | 13.50 |

**B. Diversion from Matrikundia pick up Weir**

It was observed that inflow in the reservoir from its catchment is very poor the reservoir was filling on an average only once in 3 years. Besides irrigation, drinking water demand of Bhilwara was also to be met from Meja dam.

To overcome the shortage of water in Meja dam, the construction feeder known as Meja feeder and pick up weir across Banas near Matrikundia to divert surplus water from Banas river in flood season was taken up in 1970, the Meja feeder and appurtenant works were completed in 1980 the salient features of Meja feeder and Matrikundia pick up weir are as under:-

**1. Matrikundia Pickup Weir**

**(a) Catchment area**

(i) Gross 3415 $km^2$

(ii) Free 943 $km^2$

**(b) Storage Capacity**

(i) Gross 50.65 $Mm^3$

(ii) Live 49.97 $Mm^3$

**2. Meja Feeder**

(a) Discharge Capacity 8.50 Cumecs

(b) Length of Feeder 58.20 km

The water diverted from Matrikundia would be available at 75%, 50%, 25% dependability are 0.25 $Mm^3$, 19.81 $Mm^3$ and 32.83 $Mm^3$ respectively.

**C. Effective Live storage capacity**

The dam was commissioned in 1957 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.14 $Mm^3$ per year for1049 $km^2$, $Mm^3$/yr | 7.28 | 8.65 | 11.37 | 14.15 |
| Effective Live Storage Capacity, $Mm^3$/yr | 76.72 | 75.35 | 72.60 | 69.85 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**D.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 15.65%.

**E. Non-Agriculture demand**

There is domestic demand of 3.65 $Mm^3$ for cities and towns linked with reservoir and there is no industrial demand so remaining surface water is being used for irrigation. However the balance domestic demands of Bhilwara city and rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be supplied by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.91 | 1.87 | 2.32 | 2.59 |
| Live Stock | 0.74 | 0.77 | 0.84 | 0.90 |
| Total | 1.65 | 2.64 | 3.16 | 3.49 |

**F. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Meja and Mandalgarh Block) is 6.05 $Mm^3$/year. The average yield of water per well in potential zone is 9,714 $m^3$/yr and number of well in the command area is 2724.

Total Ground Water Potential

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 5.87 | 4.33 | 3.76 | 3.39 |
| 75% | 5.92 | 4.38 | 3.80 | 3.42 |
| 50% | 16.37 | 11.02 | 10.35 | 9.89 |
| 25% | 26.46 | 19.07 | 18.50 | 18.04 |

**G. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 24 mm with this amount of water.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 112 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in additional to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.71.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,821 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 182.83 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 254.38%. Hence, no new wells recommended in this project command area.

**(iii)Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$

of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.51 per $m^3$ considering H = 55.61 m. (see Section 6 of Annex 1)

**Conclusions:**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Meja irrigation project is 1.53, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 1.07.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 88.68 | 110.72 | 80.13 | 129.60 | 94.17 | 150.34 | 109.60 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 16 (of 35) according the economic prioritization approach and 9 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.25 Murlia Irrigation Project*

**1. Introduction**

Murlia irrigation project has been construction on local Drain which joins Gambhiri River, Tributary of Banas River. The dam and reservoir are situated near village Murlia of Nimbahera Tehsil in Chittaurgarh district Construction of dam and Canal was completed in 1967.

**2. Important Features**

**(a) Catchment**

(i) Gross 111.4 $km^2$

(ii) Free 111.4 $km^2$

**(b) Design mean yield** 12.00 $Mm^3$

**(c) Command Area**

(i) GCA 1497 ha

(ii) CCA 1323 ha

**(d) Storage Capacity**

(i) Gross 9.62 $Mm^3$

(ii) Live 8.47 $Mm^3$

## 3. Project Review

The project can be seen in various aspects which are given below:-

### A. Availability of Surface Water

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 21.16 | 3.40 | 9.30 | 15.60 | 23.60 |

### B. Effective Live Storage Capacity

The dam was commissioned in 1956 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.01526 $Mm^3$ per year for111.4 $km^2$, $Mm^3$/yr | 0.63 | 0.78 | 1.07 | 1.36 |
| Effective Live Storage Capacity, $Mm^3$/yr | 8.19 | 8.11 | 7.95 | 7.79 |

Since the live capacity in 2060 is much less than 75% dependable yield therefore siltation in dam will have adverse effect on availability of water. But before considering the raising the actual flow with spill may be examined.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 20.31%.

### D. Non-Agriculture demand

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.05 | 0.10 | 0.12 | 0.13 |
| Live Stock | 0.04 | 0.05 | 0.06 | 0.06 |
| Total | 0.09 | 0.15 | 0.18 | 0.19 |

### E. Ground Water Availability

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Chittaurgarh & Nimbahera Block) is 0.58 $Mm^3$/yr. The average yield of water per well in potential zone is 26,880 $m^3$/yr and number of well in the command area is 289.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.41 | 1.66 | 1.63 | 1.62 |
| 75% | 4.89 | 3.23 | 3.16 | 3.09 |
| 50% | 4.89 | 3.23 | 3.16 | 3.09 |
| 25% | 4.89 | 3.23 | 3.16 | 3.09 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 205mm with this amount of water one irrigation can be done on an average to entire CCA.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 573 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.75.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 10,486 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 13.87 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 225.47%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.47 per $m^3$ considering H = 50.35 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Murlia irrigation project is 3.44, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.38.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby.

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 26.83 | 34.59 | 27.14 | 40.55 | 31.22 | 45.01 | 34.19 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 7 (of 35) according the economic prioritization approach and 15 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.26 Narain Sagar Jalia Irrigation Project*

**1. Introduction**

Narain Sagar Jalia irrigation project has been construction on local drain having small catchment. This dam is mainly fed with water of Khari River a tributary of Banas River. The dam and reservoir are situated near Jalia II village of Beawer Tehsil in Ajmer. The Khari waters is diverted to this dam from Khari pick up weir constructed on Khari river near village Garwal this weir has diversion Sluices in its side wall through which Khari flood water are let into Narain Sagar through feeder. The Narain Sagar Dam considered unsafe above 3.50 m gauge though full gauge of the tank is 4.88 m. therefore the dam rarely filled to its full capacity due to this reasons. The dam and canal was completed in 1967.

**2. Important Features**

**(a) Catchment**

(i) Gross 840.89 $km^2$

(ii) Free 23.82 $km^2$

**(b) Command Area**

(i) GCA 4351 ha

(ii) CCA 4087 ha

**(c) Storage Capacity**

(i) Gross 19.95 $Mm^3$

(ii) Live 19.82 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 4.04 | 0.00 | 0.30 | 1.40 | 4.70 |

**B. Effective Live storage capacity**

The dam was commissioned in 1967 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.003 $Mm^3$ per year for 23.82 $km^2$, $Mm^3$/yr | 0.14 | 0.17 | 0.23 | 0.30 |
| Effective Live Storage Capacity, $Mm^3$/yr | 19.76 | 19.74 | 19.71 | 19.67 |

Since the live capacity in 2060 is nearly more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon and irrigation done. The overall irrigation efficiency worked out to 5.25%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the Urban and rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.17 | 0.34 | 0.42 | 0.47 |
| Live Stock | 0.13 | 0.14 | 0.15 | 0.17 |
| Total | 0.30 | 0.48 | 0.57 | 0.64 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Massuda Block) is 0.82 $Mm^3$. The average yield of water per well in potential zone is 27,153 $m^3$/yr and number of well in the command area is 116.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follows.

| Dependability | Total Ground Water available for Irrigation $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.70 | 0.45 | 0.35 | 0.27 |
| 75% | 0.88 | 0.55 | 0.45 | 0.37 |
| 50% | 1.53 | 0.90 | 0.80 | 0.72 |
| 25% | 3.15 | 1.96 | 1.86 | 1.78 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 4 mm with this amount of water even land preparation in not possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 41 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.78.)

## Cost

### A. Capital of cost

### (i) Surface water

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,285 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 46.12 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

### (ii) Ground water

The stage of groundwater development in the project command area is 245.63%. Hence, no new wells recommended in this project command area.

### (iii) Annual O & M cost

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.53 per $m^3$ considering H = 57.47 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Narain Sagar Jalia irrigation project is 0.82, which reflects a negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non viable project in economic terms. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 2.39.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 7.46 | 11.00 | 7.42 | 13.53 | 9.10 | 15.70 | 10.41 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 33 (of 35) according the economic prioritization approach and 35 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.27 Rajsamand Irrigation Project*

**1. Introduction**

Rajsamand irrigation project has been construction on Gomati River which is a Tributary of Banas River. The dam and reservoir are situated near Rajsamand in Rajsamand district, the Rajsamand dam was constructed by erstwhile rulers of the than Udaipur state in the 17$^{th}$ Century (1676) mainly for recreation purposes and Wild life preservation. After formation of state of Rajasthan it was planned to utilize water for irrigation purposed accordingly a canal system was constructed in 1963. It was observed that the average yield storage capacity of Nandsamand is more than its storage capacity it is therefore decided to divert surplus yield to Rajsamand.

**2. Important Features**

**(a) Catchment**

(i) Gross 523.18 km$^2$

(ii) Free 432.865 km$^2$

**(b) Design mean yield** 41.35 Mm$^3$

**(c) Command Area**

(i) GCA 14225 ha

(ii) CCA 10450 ha

(iii) Annual Irrigation 5225 ha

**(d) Storage Capacity**

(i) Gross 107.00 Mm$^3$

(ii) Live 98.50 Mm$^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water from Own Catchment**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, Mm$^3$/yr (Ref. Report 4.3) | 6.23 | 0.00 | 0.00 | 1.00 | 6.30 |

**B. Diversion from Nandsamand**

The surplus yield from Nandsamand reservoir on Banas river is being diverted to Rajsamand reservoir through Khari feeder the water diverted from Nandsamand would be available at 50% & 25% dependabilities are 5.63 Mm$^3$, 32.00 Mm$^3$ respectively.

**C. Effective Live storage capacity**

The dam was commissioned in 1963 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.06 $Mm^3$ per year for 432.865 $km^2$, $Mm^3$/yr | 2.66 | 3.23 | 4.36 | 5.50 |
| Effective Live Storage Capacity, $Mm^3$/yr | 97.03 | 96.72 | 96.09 | 95.47 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**D.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 16.64%.

**E. Non-Agriculture demand**

There is domestic demand of 3.680 for cities and towns linked with reservoir remaining surface water is being used for irrigation. However the Urban and rural domestic (inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Urban Domestic | 0.25 | 0.33 | 0.46 | 0.57 |
| Rural Domestic | 0.62 | 1.22 | 1.43 | 1.55 |
| Live Stock | 0.50 | 0.53 | 0.59 | 0.64 |
| Total | 1.37 | 2.08 | 2.48 | 2.76 |

**F. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Chittaurgarh & Nimbahera Block) is 2.51 $Mm^3$/year. The average yield of water per well in potential zone is 9,105 $m^3$/yr and number of well in the command area is 1,374.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.64 | 0.75 | 0.31 | 0.05 |
| 75% | 1.64 | 0.75 | 0.31 | 0.05 |
| 50% | 3.81 | 2.37 | 1.83 | 1.47 |
| 25% | 12.51 | 12.51 | 12.51 | 12.18 |

**G. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 6 mm with this amount of water even land preparation will not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 43 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.91.)

## Cost

**A. Capital of cost**

**(i) Surface water-**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,821 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 102.63 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 152.88%. Hence, no new wells recommended in this project command area.

**(iii)Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.55 per $m^3$ considering H = 59.14 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Rajsamand irrigation project is 2.14, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.98.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 39.59 | 58.46 | 32.64 | 67.41 | 36.89 | 75.51 | 41.30 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 12 (of 35) according the economic prioritization approach and 11 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.28 Sardarsamand Irrigation Project*

**1. Introduction**

Sardarsamand irrigation project has been construction on Sukaria tributaries of Luni. The dam and reservoir are situated near Sojat City in Pali district. Construction of dam and Canal was completed in 1904.

**2. Important Features**

**(a) Catchment**

(i) Gross 2064 $km^2$

(ii) Free 2064 $km^2$

**(b) Command Area**

(i) GCA 13245 ha

(ii) CCA 10325 ha

**(c) Storage Capacity**

(i) Gross 88.23 $Mm^3$

(ii) Live 88.23 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 53.67 | 0.00 | 0.20 | 6.00 | 65.40 |

**B. Effective Live storage capacity**

The dam was commissioned in 1904 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0194 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.40 $Mm^3$ per year for 2,064 $km^2$, $Mm^3$/yr | 42.44 | 46.44 | 54.45 | 62.46 |
| Effective Live Storage Capacity, $Mm^3$/yr | 45.78 | 41.78 | 33.77 | 25.76 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage is reservoir at the end of monsoon and irrigation done. The overall irrigation efficiency worked out to 22.79%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.50 | 0.78 | 0.88 | 0.96 |
| Live Stock | 0.24 | 0.26 | 0.28 | 0.31 |
| Total | 0.74 | 1.04 | 1.12 | 1.27 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Rohat, Sojat Block) is 2.27$Mm^3$/year. The average yield of water per well in potential zone is 21,690 $m^3$/yr and number of well in the command area is 104. The stage of groundwater development in the project command area is 19.87%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.05 | 1.57 | 1.44 | 1.32 |
| 75% | 2.06 | 1.58 | 1.45 | 1.32 |
| 50% | 2.26 | 2.43 | 2.30 | 2.18 |
| 25% | 2.26 | 8.95 | 8.95 | 8.95 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 9mm which negligible water for irrigation.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 30 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow for which 309 additional wells in the project command area would be needed over the next 10 years, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.96.)

**Cost**

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 7,500 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 77.44 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The average depth to basement in project command area is 72 m (based on Final Report No. 4.4 of this study). Considering the depth of well as 57 m (80% of depth to basement), the cost of one well works out to Rs. 45,715 and the total cost of wells works out to Rs. 14.13 million. (see section 4.2 of Annex 1)

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.46 per $m^3$ considering H = 49.30 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Sardarsamand irrigation project is 1.95, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.91.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 24.53 | 58.84 | 39.86 | 62.07 | 43.36 | 74.03 | 54.79 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 6 (of 35) according the economic prioritization approach and 2 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.29 Sareri Irrigation Project*

**1. Introduction**

Sareri irrigation project has been construction on Mansi River which joins Banas River. The dam and reservoir are situated near town Gulabpura of Hurda Block in Bhilwara district Construction of dam and Canal was completed in 1957.

**2. Important Features**

**(a) Catchment**

(i) Gross 565 $km^2$

(ii) Free 369 $km^2$

**(b) Command Area**

(i) GCA 14170 ha

(ii) CCA 9717 ha

**(c) Storage Capacity**

(i) Gross 55.7 $Mm^3$

(ii) Live 55.1 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 20.71 | 0.50 | 2.60 | 7.70 | 28.00 |

**B. Effective Live storage capacity**

The dam was commissioned in 1957 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.05 $Mm^3$ per year for 369 $km^2$, $Mm^3$/yr | 2.56 | 3.04 | 4.01 | 4.98 |
| Effective Live Storage Capacity, $Mm^3$/yr | 53.14 | 52.65 | 51.69 | 50.72 |

Since the live capacity in 2060 is much more than 50% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 45.32%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.47 | 0.96 | 1.19 | 1.34 |
| Live Stock | 0.40 | 0.41 | 0.45 | 0.48 |
| Total | 0.87 | 1.37 | 1.64 | 1.82 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Hurda Block) is 2.46 $Mm^3$/year. The average yield of water per well in potential zone is 16,614 $m^3$/yr and number of well in the command area is 1060.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 2.32 | 1.58 | 1.28 | 1.08 |
| 75% | 3.04 | 2.18 | 1.88 | 1.68 |
| 50% | 4.78 | 3.65 | 3.36 | 3.16 |
| 25% | 11.72 | 9.51 | 9.21 | 9.01 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 62 mm with this amount of water even land preparation will not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 111 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.97.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 11,138 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 108.23 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**Ground water**

The stage of groundwater development in the project command area is 122.82%. Hence, no new wells recommended in this project command area.

**(ii) Annual O & M cost**

The energy required per $m^3$ of waters pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.52 per $m^3$ considering H = 56.03 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Sareri irrigation project is 0.93, which reflects a negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non viable project in economic terms. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.95.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 73.72 | 76.98 | 67.04 | 90.97 | 79.08 | 106.25 | 92.25 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 14 (of 35) according the economic prioritization approach and 12 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.30 Somkagdar Irrigation Project*

**1. Introduction**

Somkagdar irrigation project has been construction on Som River which is tributary of Mahi River. The dam and reservoir are situated near Kagdar village of Kherwara Tehsil in Udaipur district Construction of dam and Canal was completed in 1983.

**2. Important Features**

**(a) Catchment**

(i) Gross 748 $km^2$

(ii) Free 564 $km^2$

**(b) Command Area**

(i) GCA 9887 ha

(ii) CCA 5739 ha

**(c) Storage Capacity**

(i) Gross 36.19 $Mm^3$

(ii) Live 34.44 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 53.64 | 0.50 | 1.90 | 14.60 | 58.60 |

**B. Effective Live storage capacity**

The dam was commissioned in 1983 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.243 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.14 $Mm^3$ per year for 564 $km^2$, $Mm^3$/yr | 1.99 | 3.36 | 6.10 | 8.84 |
| Effective Live Storage Capacity, $Mm^3$/yr | 33.45 | 32.70 | 29.99 | 27.25 |

Since the live capacity in 2060 is much more than 50% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 43.50%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.57 | 1.21 | 1.55 | 1.76 |
| Live Stock | 0.45 | 0.47 | 0.51 | 0.55 |
| Total | 1.02 | 1.68 | 2.06 | 2.31 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Dungarpur, Udaipur Block) is 1.21 $Mm^3$/year. The average yield of water per well in potential zone is 27,117 $m^3$/yr and number of well in the command area is 354. The stage of groundwater development in the project command area is 35.44%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.52 | 0.00 | 0.00 | 0.00 |
| 75% | 1.04 | 0.32 | 0.00 | 0.00 |
| 50% | 5.69 | 4.56 | 4.21 | 3.98 |
| 25% | 9.60 | 9.60 | 9.35 | 8.20 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 156 mm with this amount of water one irrigation can be supplied on an average to entire area.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 255 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.102.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,639 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 55.32 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

No new wells recommended in this project command area as existing wells are sufficient to withdraw the available (utilizable) groundwater potential.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.44 per $m^3$ considering H = 48..27 m. (see Section 6 of Annex 1)

## Conclusions

The benefit/cost ratio resulting from the analysis of the proposed improvements in Somkagdar irrigation project is 0.88, which reflects a minor difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and

therefore reflects an economic non viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.49.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 40.35 | 52.43 | 47.60 | 55.61 | 49.07 | 0.00 | 50.34 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 22 (of 35) according the economic prioritization approach and 21 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.31 Tordi Sagar Irrigation Project*

**1. Introduction**

Tordi Sagar irrigation project has been construction on Shodra River which is a tributary of Banas River. The dam and reservoir are situated near village Tordi of Todaraisingh Tehsil in Tonk district Construction of dam and Canal was completed in 1888.

**2. Important Features**

**(a) Catchment**

(i) Gross 704.88 $km^2$

(ii) Free 704.88 $km^2$

**(b) Command Area**

(i) GCA 16574 ha

(ii) CCA 13960 ha

**(c) Storage Capacity**

(i) Gross 47.12 $Mm^3$

(ii) Live 47.12 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 51.32 | 0.10 | 0.30 | 9.20 | 81.60 |

**B. Effective Live storage capacity**

The dam was commissioned in 1888 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.02 $Mm^3$ per year for 704.88 $km^2$, $Mm^3$/yr | 11.26 | 12.18 | 14.03 | 15.88 |
| Effective Live Storage Capacity, $Mm^3$/yr | 35.85 | 34.93 | 33.08 | 31.25 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage is reservoir at the end of monsoon and irrigation done. The overall irrigation efficiency worked out to 28.43%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.43 | 0.85 | 1.02 | 1.12 |
| Live Stock | 0.31 | 0.33 | 0.38 | 0.42 |
| Total | 0.74 | 1.18 | 1.40 | 1.54 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Malpura & Todaraisingh Block) is 10.29 $Mm^3$/year. The average yield of water per well in potential zone is 29,010 $m^3$/yr and number of well in the command area is 840. The stage of groundwater development in the project command area is 83.11%.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 6.81 | 5.81 | 5.56 | 5.41 |
| 75% | 6.95 | 5.90 | 5.66 | 5.50 |
| 50% | 10.92 | 8.76 | 8.51 | 8.36 |
| 25% | 22.81 | 17.01 | 16.17 | 15.42 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 28 mm with this amount of water even land preparation water requirement will not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 107 mm at 50%

dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.107.)

## Cost

### A. Capital of cost

### (i) Surface water

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 14,370 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 192.43 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

### (ii) Ground water

No new wells recommended in this project command area as existing wells are sufficient to withdraw the available (utilizable) groundwater potential.

### (iii) Annual O & M cost

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.52 per $m^3$ considering H = 55.85 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Tordi Sagar irrigation project is 0.87, which reflects a negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non viable project in economic terms. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 1.50.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 92.18 | 101.98 | 85.49 | 110.44 | 92.56 | 119.64 | 100.33 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 30 (of 35) according the economic prioritization approach and 23 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.32 Udai Sagar Irrigation Project*

**1. Introduction**

Udai Sagar irrigation project has been construction on Berach River which joins Banas River. The dam and reservoir are situated near village Bhichri of Girwa Tehsil in Udaipur district the Udai Sagar project was constructed by erstwhile rulers of Udaipur state in 1580 AD and in 1964 the canal system have been remodeled and storage capacity of dam was increased.

**2. Important Features**

**(a) Catchment**

(i) Gross 477.00 $km^2$

(ii) Free 196.00 $km^2$

**(b) Design mean yield** 22.13 $Mm^3$

**(c) Command Area**

(i) GCA 5092 ha

(ii) CCA 4650 ha

(iii) Annual Irrigation

As Planned 1943 ha

**(d) Storage Capacity**

(i) Gross 31.14 $Mm^3$

(ii) Live 27.59 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 26.40 | 0.90 | 2.60 | 6.90 | 16.60 |

The yield base on SWAT model indicates that the reservoir has filled but 75% dependability even less the gross storage capacity therefore the aspect increasing the capacity of reservoir is being not considered.

**B. Effective Live storage capacity**

The dam was commissioned in 1964 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.03 $Mm^3$ per year for 196 $km^2$, $Mm^3$/yr | 1.18 | 1.44 | 1.95 | 2.46 |
| Effective Live Storage Capacity, $Mm^3$/yr | 26.94 | 26.80 | 26.52 | 26.23 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon and irrigation done the canal overall efficiency worked out to 16.09%.

**D. Non-Agriculture demand**

There is industrial demand of 5.1 $Mm^3$ for Hindustan zinc and Udaipur cement plant linked with reservoir and remaining surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Urban Domestic | 0.24 | 0.28 | 0.36 | 0.43 |
| Rural Domestic | 0.27 | 0.57 | 0.73 | 0.83 |
| Live Stock | 0.19 | 0.20 | 0.22 | 0.25 |
| Total | 0.70 | 1.05 | 1.31 | 1.51 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Bhinder & Girwa Block) is 1.21 $Mm^3$/year. The average yield of water per well in potential zone is 9,480 $m^3$/yr and number of well in the command area is 906.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3$/yr | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 0.76 | 0.32 | 0.06 | 0.00 |
| 75% | 0.76 | 0.32 | 0.06 | 0.00 |
| 50% | 1.27 | 0.63 | 0.37 | 0.18 |
| 25% | 6.55 | 3.87 | 3.61 | 3.42 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 5 mm with this irrigation is not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 53 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling,

adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.108.)

## Cost

### A. Capital of Cost

#### (i) Surface water

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 16,744 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 77.86 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

#### (ii) Ground Water

The stage of groundwater development in the project command area is 141.65%. Hence, no new wells recommended in this project command area.

#### (iii) Annual O & M Cost

The energy required per $m^3$ of waters pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh. The cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.50 per $m^3$ considering H = 54.05 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Udai Sagar irrigation project is 0.73, which reflects a negative difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects a non viable project in economic terms. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 1.22.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 18.74 | 22.20 | 15.96 | 23.48 | 16.51 | 0.00 | 18.17 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 35 (of 35) according the economic prioritization approach and 34 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.33 Ummed Sagar Project*

**1. Introduction**

Ummed Sagar irrigation project has been construction across river Khari which a tributary of Banas River. The dam and reservoir are situated near village Amarpura of Shahpura Tehsil in Bhilwara district Construction of dam and Canal was completed in 1917.

**2. Important Features**

**(a) Catchment**

(i) Gross 407 $km^2$

(ii) Free 174 $km^2$

**(b) Design mean yield – 28.00 $Mm^3$**

**(c) Command Area**

(i) GCA 5837 ha

(ii) CCA 2968 ha

(iii) Annual Irrigation

As Planned (Rabi only) 2078 ha

**(d) Storage Capacity**

(i) Gross 17.77 $Mm^3$

(ii) Live 17.77 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 26.20 | 0.70 | 6.10 | 15.30 | 39.80 |

The yield base on SWAT indicates that the reservoir has filled at 75% dependability even less then gross storage capacity therefore the aspect increasing the capacity of reservoir is not being considered.

**B. Effective Live storage capacity**

The dam was commissioned in 1917 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.02 $Mm^3$ per year for 174 $km^2$, $Mm^3$/yr | 2.12 | 2.35 | 2.80 | 3.26 |
| Effective Live Storage Capacity, $Mm^3$/yr | 15.65 | 15.42 | 14.97 | 14.51 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage is reservoir and irrigation done. The overall irrigation efficiency in worked out to 40%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.14 | 0.28 | 0.34 | 0.38 |
| Live Stock | 0.12 | 0.13 | 0.14 | 0.14 |
| Total | 0.26 | 0.41 | 0.48 | 0.52 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Shahpura Block) is 1.23 $Mm^3$/year. The average yield of water per well in potential zone is 43,155 $m^3$/yr and number of well in the command area is 228.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation , $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.56 | 1.21 | 1.14 | 1.09 |
| 75% | 3.66 | 2.71 | 2.64 | 2.59 |
| 50% | 7.24 | 5.27 | 5.10 | 4.93 |
| 25% | 7.38 | 5.30 | 5.10 | 4.93 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 213 mm with this amount of water one irrigation can be done on an average to entire CCA.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 426 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.109.)

**Cost**

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 14,219 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 48.34 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 147.29%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.45 per $m^3$ considering H = 48.97 m. (see Section 6 of Annex 1)

**Conclusions**

The benefit/cost ratio resulting from the analysis of the proposed improvements in Ummed Sagar irrigation project is 1.51, which reflects the positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.67.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 53.18 | 57.14 | 49.16 | 67.09 | 57.69 | 77.26 | 66.42 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 23 (of 35) according the economic prioritization approach and 27 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.34 Vallabh Nagar Irrigation Project*

**1. Introduction**

Vallabh Nagar irrigation project has been construction on across river Berach which is tributary of Banas River. The dam and reservoir are situated near village Ranchorpur of Vallabh Nagar Tehsil in Udaipur district Construction of dam and Canal was completed in 1966.

**2. Important Features**

**(a) Catchment**

(i) Gross 1200.64 $km^2$

(ii) Free 458.24 $km^2$

**(b) Design mean yield** 33 $Mm^3$

**(c) Command Area**

(i) GCA 8405 ha

(ii) CCA 6464 ha

(iii) Annual Irrigation: 3238 ha

**(d) Storage Capacity**

(i) Gross 30.46 $Mm^3$

(ii) Live 28.78 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3), $Mm^3$/yr , $Mm^3$/yr | 22.71 | 0.10 | 0.30 | 2.70 | 8.80 |

The yield based on SWAT model indicates that the reservoir has filled at 75% dependability even less then gross storage capacity therefore the aspect increasing the capacity of reservoir is being not considered.

**B. Effective Live storage capacity**

The dam was commissioned in 1966 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of 0.131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.06 $Mm^3$ per year for 458.24 $km^2$, $Mm^3$/yr | 2.64 | 3.24 | 4.44 | 5.64 |
| Effective Live Storage Capacity, $Mm^3$/yr | 27.33 | 27.00 | 26.02 | 24.82 |

Since the live capacity in 2060 is much more than 75% dependable yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir at the end of monsoon irrigation done and overall efficiency is worked out to 12%.

**D. Non-Agriculture Demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3/yr$ | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.32 | 0.68 | 0.87 | 0.99 |
| Live Stock | 0.17 | 0.18 | 0.20 | 0.22 |
| Total | 0.49 | 0.86 | 1.07 | 1.21 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Binders, Mavli Block) is 1.25 $Mm^3$/year. The average yield of water per well in potential zone is 10,767 $m^3$/yr and number of well in the command area is 858.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 1.09 | 0.58 | 0.35 | 0.19 |
| 75% | 1.20 | 0.65 | 0.41 | 0.26 |
| 50% | 2.57 | 1.45 | 1.21 | 1.06 |
| 25% | 6.06 | 3.48 | 3.25 | 3.10 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 21 mm with this amount of water even land preparation water requirement will not be possible.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 61 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.112.)

## Cost

**A. Capital of cost**

**(i) Surface water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 10,353 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 66.92 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 184.78%. Hence, no new wells recommended in this project command area.

**(iii)Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per KW, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.50 per $m^3$ considering H = 53.84 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Vallabh Nagar irrigation project is 1.08, which reflects a positive difference between the with-plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 1.85.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 20.45 | 24.65 | 17.36 | 26.44 | 18.27 | 29.31 | 19.96 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 29 (of 35) according the economic prioritization approach and 31 (of 35) in the social prioritization approach (as described in section 10).

### *9.2.35 Wagan Irrigation Project*

**1. Introduction**

Wagan irrigation project has been construction on Wagan River which joins Banas River. The dam and reservoir are situated near village Pholodra of Doongla Tehsil in Chittaurgarh district Construction of dam and Canal was completed in 1982.

**2. Important Features**

**(a) Catchment**

(i) Gross 307 $km^2$

(ii) Free 256 $km^2$

**(b) Design mean yield** Not available

**(c) Command Area**

(i) GCA 9790 ha

(ii) CCA 8270 ha

(iii) Annual Irrigation

As Planned (Rabi only) 5541 ha

**(d) Storage Capacity**

(i) Gross 40.65 $Mm^3$

(ii) Live 37.58 $Mm^3$

**3. Project Review**

The project can be seen in various aspects which are given below:-

**A. Availability of Surface Water**

| Dependability | Mean | 90% | 75% | 50% | 25% |
|---|---|---|---|---|---|
| Based on SWAT Model Result, $Mm^3$/yr (Ref. Report 4.3) | 30.43 | 2.10 | 4.80 | 24.10 | 43.00 |

**B. Effective Live storage capacity**

The dam was commissioned in 1982 and due to siltation its effective storage capacity is likely to reduced taking siltation at rate of .0131 ha m/year per $km^2$. The silt deposited and effective storage capacity will be as under.

| Year | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Silt Volume at 0.04 $Mm^3$ per year for 256 $km^2$, $Mm^3$/yr | 0.94 | 1.28 | 1.95 | 2.62 |
| Effective Live Storage Capacity, $Mm^3$/yr | 37.06 | 36.88 | 36.51 | 36.14 |

Since the live capacity in 2060 is nearly more than three times of the mean yield therefore siltation in dam will have no adverse effect on availability of water.

**C.** The overall irrigation efficiency has been examined on the water availability from storage in reservoir and irrigation done. The overall irrigation efficiency is worked out to 17.32%.

**D. Non-Agriculture demand**

There is no industrial and domestic demand for cities and towns linked with reservoir and entire surface water is being used for irrigation. However the rural domestic (Inclusive of institutional and other demands) and live stock of the command area is proposed to be used entirely by Groundwater.

| Demands, $Mm^3$/yr | 2010 | 2020 | 2040 | 2060 |
|---|---|---|---|---|
| Rural Domestic | 0.54 | 1.08 | 1.30 | 1.43 |
| Live Stock | 0.54 | 0.57 | 0.64 | 0.72 |
| Total | 1.08 | 1.65 | 1.94 | 2.15 |

**E. Ground Water Availability**

Natural Ground Water Potential:

The ground water available through rainfall recharge in command area worked out on proportion basic of geographical area to command area and relevant potential zone (Barisadri, Bhadesar, and Dungla Block) is 4.53 $Mm^3$. The average yield of water per well in potential zone is 14,160 $m^3$/yr and number of well in the command area is 2186.

Total Ground Water Potential:

Including return flow from irrigation system as well as from local domestic water supply systems the total Ground Water Potential is as follow.

| Dependability | Total Ground Water available for Irrigation, $Mm^3/yr$ | | | |
|---|---|---|---|---|
| | 2010 | 2020 | 2040 | 2060 |
| 90% | 5.71 | 4.31 | 3.99 | 3.75 |
| 75% | 7.16 | 5.21 | 4.89 | 4.65 |
| 50% | 17.52 | 11.65 | 11.33 | 11.10 |
| 25% | 24.47 | 15.91 | 15.47 | 15.11 |

**F. Review of the extent of CCA**

The annual irrigation depth achievable with plan (as per planning work sheet) i.e. with the proposed improvement from surface water alone at 50% dependability is 82 mm with this amount of water one irrigation can be supplied on an average to entire CCA.

Thus under present conditions of water only deficit irrigation can be sustained, including groundwater however as can be seen in planning Worksheet the total annual depth of water available for irrigation can be about 294 mm at 50% dependability which can allow irrigation for entire CCA. This is possible with full utilization of the available groundwater including return flow, in addition to improving the canal system and on farm remedial measures, such as land leveling, adjustment of plot size, introduction of modern irrigation methods and introduction impermeable conduits. (Also refer Section 5.113.)

## Cost

**A. Capital of cost**

**(i) Surface Water**

As per unit cost analysis presented in Section 2 of Annex 1, the cost of Rehabilitation of canal system is taken as Rs. 9,639 /ha which includes the cost of improvement of field channel and water course at Rs 2,500 per ha, which works out to Rs. 79.71 million. (see Section V of the Project Worksheet in Annex 4 in soft copy)

**(ii) Ground water**

The stage of groundwater development in the project command area is 178.72%. Hence, no new wells recommended in this project command area.

**(iii) Annual O & M cost**

The energy required per $m^3$ of water pumped is H/250 where H is head of pumping in meter. Taking Rs. 2.31 as cost of pumping per kWh, the cost of pumping per $m^3$ of water will be $\frac{H}{250} * 2.31 = \frac{H}{108}$ which works out to Rs. 0.53 per $m^3$ considering H = 57.45 m. (see Section 6 of Annex 1)

## Conclusions:

The benefit/cost ratio resulting from the analysis of the proposed improvements in Wagan irrigation project is 2.67, which reflects a positive difference between the with-

plan and without-plan situations in terms of crop intensities and benefits in net terms and therefore reflects an economic viable project. (see section VIIb of the Project Worksheet in Annex 4 in soft copy).

The project presents a water unit cost (per $m^3$) of Rs. 0.60.

The total mean income expectancy derived from this project after implementation of the required investments in the present and future time points are presented hereby:

| Million Rs./yr | Present | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|
| | Existing project | With project scenario | Without project scenario | With project scenario | Without project scenario | With project scenario | Without project scenario |
| Weighted mean irrigation benefit | 85.36 | 113.97 | 84.94 | 131.26 | 97.47 | 146.88 | 108.78 |

According to the projects' set of prioritization indicators and considerations it is ranked as number 5 (of 35) according the economic prioritization approach and 5 (of 35) in the social prioritization approach (as described in section 10).

## 9.3 Economic Analysis

An economic analysis of each of the appraised Major and Medium irrigation projects was performed, to give the economic viability indicators required for analyzing alternatives and ranking the various improvement plans in a priority order. This analysis uses the Crop-Mix Linear Programming (CMLP) model described in Annex 3. The computed values of the economic indicators are given in the priory ranking table in Section 10.3 below.

### *9.3.1 Crops and Projects' set of constraints*

The economic indicators which are calculated project wise are fully dependent on the constraints and conditions imposed on the assumption and variables of each of the crops in each of the existing irrigation projects. The set of constraints which are determined for the project affect the feasible results, from which the CMLP chooses the optimum. Set of constraints for each crop in each project is as detailed below.

### *9.3.2 Land Occupancy Constraints*

For each crop taken into consideration as possible for cultivation within a project CCA, it is noted whether the crop is under cultivation in each of the months (inserted as a series of "0" for no cultivation within the month or "1" for land occupancy). If a certain crop is not under cultivation within a certain month, then the land is considered as unoccupied for the usage of other crop's cultivation, if required. The land occupancy constraints are given in Table 9.2 below:

Table 9.2 Crops' land occupancy constraints

| Crop/ Month | | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Bajra | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 2 | Barley | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 3 | Coriander | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 4 | Cotton | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 5 | Cumin | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 6 | Gram | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 7 | Groundnut | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 8 | Maize | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 9 | Mustard | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 10 | Soybean | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 11 | Wheat | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

### *9.3.3 Crops Constraints Coefficient*

For each project, the list of cultivable crops were grouped, and for each group a minimum and maximum percentage of land occupancy was given. The coefficients are given as a series of "0" and "1". The "1" values are given on the relevant group columns, so that for each crop there is a "1" value for the maximum possible land occupancy (given in the CMLP as a positive value) and in the minimum possible land occupancy (given as a negative value). These constraints assure that the demands of minimum land allocation are met, even in case of no economic viability, on the one hand, and that no further allocation is given for beneficiary crops beyond the maximum limit, on the other (Ra: Rabi; Kh: Kharif). Table 9.3 to 9.18 present the project wise adopted cropping pattern for economic analysis.

Table 9.3 Cropping Pattern and crops constraints coefficient for: Arwar, Khari, Kothari, Meja, Sareri and Ummed Sagar Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Maize | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 75% | 25% | 15% | 10% | 30% | 100% | 100% | -50% | -10% | -5% | -3% | -10% |

Table 9.4 Cropping Pattern and crops constraints coefficient for: Badgaon, Bagolia, Jaisamand, Udaisagar and Vallabhnagar Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Maize | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 75% | 30% | 15% | 50% | 15% | 100% | 100% | -30% | -15% | -5% | -25% | -5% |

Table 9.5 Cropping Pattern and crops constraints coefficient for: Bassi, Bhupal sagar, Dindoli, Murlia and Wagon Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Ra-Gram | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Maize | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Kh-Cotton | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Max / Min Land Occupancy | 70% | 40% | 20% | 10% | 40% | 100% | 100% | -40% | -30% | -5% | -3% | -20% |

Table 9.6 Cropping Pattern and crops constraints coefficient for: Bilas and Gopalpura Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Mustard | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Wheat | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Coriander | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Soyabean | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Max / Min Land Occupancy | 40% | 40% | 30% | 10% | 100% | 100% | 100% | -30% | -30% | -20% | -5% | 100% |

Table 9.7 Cropping Pattern and crops constraints coefficient for: Chandsen bheru, Galwania and Tordi Sagar Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Mustard | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Wheat | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Maize | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 65% | 35% | 10% | 30% | 10% | 100% | 100% | -40% | -20% | -5% | -10% | -5% |

Table 9.8 Cropping Pattern and crops constraints coefficient for: Chapparwara Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Barley | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Wheat | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Bajra | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Groundnut | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 20% | 60% | 30% | 15% | 20% | 100% | 100% | -10% | -30% | -15% | -5% | -5% |

Table 9.9 Cropping Pattern and crops constraints coefficient for: Dheel Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Mustard | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 |
| Ra-Wheat | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Gram | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Bajra | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Groundnut | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 65% | 40% | 15% | 5% | 20% | 15% | -30% | -15% | -5% | -3% | -5% | -3% |

Table 9.10 Cropping Pattern and crops constraints coefficient for: Dugari Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Coriander | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Gram | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Soybean | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Maize | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 70% | 40% | 20% | 15% | 20% | 15% | -30% | -15% | -5% | -3% | -5% | -3% |

Table 9.11 Cropping Pattern and crops constraints coefficient for: Jakham Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Gram | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Maize | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 75% | 30% | 15% | 15% | 10% | 100% | 100% | -30% | -10% | -5% | -5% | -3% |

Table 9.12 Cropping Pattern and crops constraints coefficient for: Kalisil Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Gram | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Bajra | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 65% | 40% | 15% | 10% | 15% | 100% | 100% | -30% | -15% | -5% | -3% | -5% |

Table 9.13 Cropping Patterns and crops constraints coefficient for: Lassadia and Narayan Sagar Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 |
| Ra-Barley | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Groundnut | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Maize | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 60% | 30% | 20% | 40% | 20% | 15% | -30% | -15% | -10% | -25% | -5% | -5% |

Table 9.14 Cropping Pattern and crops constraints coefficient for: Madho Sagar Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Gram | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Groundnut | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Bajra | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Kh-Maize | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 60% | 40% | 15% | 10% | 20% | 5% | -30% | -15% | -5% | -3% | -10% | -3% |

Table 9.15 Cropping Pattern and crops constraints coefficient for: Mahi Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Gram | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Ra-Wheat | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Cotton | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 25% | 80% | 15% | 100% | 100% | 100% | 100% | 100% | 100% | -10% | -30% | -3% |

Table 9.16 Cropping Pattern and crops constraints coefficient for: Chandrabhaga, Mataji ka Khera, Rajsamand Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Barley | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Maize | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 75% | 20% | 15% | 45% | 20% | 100% | 100% | -40% | -10% | -10% | -20% | -5% |

Table 9.17 Cropping Pattern and crops constraints coefficient for: Sardarsamand Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Cumin | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Maize | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 65% | 30% | 15% | 10% | 25% | 15% | -30% | -15% | -5% | -3% | -5% | -3% |

Table 9.18 Cropping Pattern and crops constraints coefficient for: Somkagdar Project

| Crop | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 6 | Group 7 | Group 8 | Group 9 | Group 10 | Group 11 | Group 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ra-Wheat | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 |
| Ra-Gram | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 |
| Ra-Mustard | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Ra-Barley | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 |
| Kh-Cotton | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 | 0 |
| Kh-Maize | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -1 |
| Max / Min Land Occupancy | 75% | 25% | 5% | 10% | 10% | 30% | -30% | -10% | -3% | -5% | -5% | -10% |

### 9.3.4 CMLP Results

Input data is processed by the CMLP model which calculates the best possible mean income, derived from agricultural cultivation in the culturable command area, subject to the constraints mentioned above.

The mean income is calculated according to:

(i) The feasible groundwater and surface water quantities (in net terms, after allocation of the priority sectors' demand).

(ii) Available land for agricultural cultivation.

And subject to:

(i) Possible crop mix.

(ii) The projection of the net income per hectare derived from agricultural activity (on the farm level).

The salient results enable the consultant to calculate and analyze a number of economic indicators and to prioritize the list of irrigation projects accordingly. The economic indicators calculated according to the CMLP results are performed according to the projects features as follows:

(i) Total project cost per unit of water supply.

(ii) Project's benefit cost ratio.

(iii) Present value of total project cost per hectare (of CCA).

(iv) Present value of added water supply for priority sectors.

The economic indicators calculated according to the CMLP results are given in table 9.19 below.

Table 9.19 Economic indicators for existing irrigation projects

| S. No. | Project Name | Class | Benefit/Cost | | Cost of Water | | CCA | | PV of Investments (per ha) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ratio | Rank | Rs./$m^3$ | Rank | ha | Rank | Rs. | Rank |
| | Set weights "A": Economic benefit approach | | 2 | | 2 | | 1 | | 2 | |
| | Set weights "B": Social approach | | 1 | | 1 | | 1 | | 1 | |
| | Improvements in Existing Projects | | Value | Rank | Value | Rank | Value | Rank | Value | Rank |
| 1 | Arwar | Medium | 2.38 | 11 | 0.66 | 16 | 7,394 | 11 | 7,591 | 18 |
| 2 | Badgaon | Medium | 0.95 | 26 | 1.52 | 31 | 6,797 | 12 | 7,056 | 14 |
| 3 | Bagolia | Medium | 0.29 | 35 | 5.44 | 35 | 3,676 | 23 | 7,691 | 24 |
| 4 | Bassi | Medium | 3.86 | 1 | 0.40 | 5 | 3,250 | 26 | 6,202 | 4 |
| 5 | Bhupal sagar | Medium | 0.93 | 27 | 1.32 | 29 | 3,873 | 22 | 9,310 | 26 |
| 6 | Bilas | Medium | 2.34 | 12 | 0.38 | 4 | 5,863 | 16 | 5,725 | 3 |
| 7 | Chandrabhaga | Medium | 1.65 | 19 | 1.29 | 28 | 3,342 | 25 | 7,691 | 21 |
| 8 | Chandsain | Medium | 1.93 | 17 | 0.85 | 19 | 2,600 | 30 | 11,646 | 35 |
| 9 | Chaparwada | Major | 0.78 | 32 | 1.54 | 32 | 11,745 | 6 | 9,793 | 30 |
| 10 | Dheel | Medium | 1.25 | 22 | 1.00 | 25 | 5,943 | 15 | 9,950 | 31 |
| 11 | Dindoli | Medium | 2.96 | 6 | 0.64 | 15 | 2,056 | 34 | 7,146 | 16 |
| 12 | Dugari | Medium | 2.16 | 13 | 0.59 | 13 | 2,251 | 32 | 7,691 | 20 |
| 13 | Galwania | Medium | 3.64 | 2 | 0.53 | 12 | 2,257 | 31 | 8,289 | 25 |
| 14 | Gopalpura | Medium | 0.50 | 34 | 0.28 | 1 | 3,557 | 24 | 6,652 | 10 |
| 15 | Jaisamand | Major | 1.23 | 23 | 0.40 | 7 | 16,000 | 4 | 11,484 | 34 |
| 16 | Jakham | Major | 2.94 | 7 | 0.36 | 2 | 28,308 | 2 | 5,452 | 1 |
| 17 | Kalisil | Medium | 1.21 | 24 | 0.44 | 8 | 4,700 | 18 | 7,691 | 22 |
| 18 | Khari | Medium | 2.70 | 9 | 0.70 | 18 | 6,478 | 13 | 7,591 | 17 |
| 19 | Kothari | Medium | 2.73 | 8 | 0.46 | 9 | 4,395 | 20 | 6,202 | 5 |
| 20 | Lassadia | Medium | 3.27 | 4 | 0.48 | 10 | 2,080 | 33 | 6,652 | 9 |
| 21 | Madhosagar | Medium | 1.78 | 18 | 0.88 | 21 | 3,232 | 27 | 11,398 | 32 |
| 22 | Mahibajaj | Major | 2.14 | 15 | 0.40 | 6 | 80,000 | 1 | 9,464 | 27 |
| 23 | Mataji Ka Khera | Medium | 3.13 | 5 | 0.86 | 20 | 3,057 | 28 | 7,691 | 19 |
| 24 | Meja | Major | 1.53 | 20 | 1.07 | 26 | 20,714 | 3 | 6,693 | 12 |
| 25 | Murlia | Medium | 3.44 | 3 | 0.38 | 3 | 1,323 | 35 | 7,146 | 15 |
| 26 | Narain Sagar Jalia | Medium | 0.82 | 31 | 2.39 | 34 | 4,087 | 21 | 7,691 | 23 |
| 27 | Rajsamand | Major | 2.14 | 14 | 0.98 | 24 | 10,450 | 7 | 6,693 | 11 |
| 28 | Sardar Samand | Major | 1.95 | 16 | 0.91 | 22 | 10,325 | 8 | 6,448 | 6 |
| 29 | Sareri | Medium | 0.93 | 28 | 0.95 | 23 | 9,717 | 9 | 5,508 | 2 |
| 30 | Somkagdar | Medium | 0.88 | 29 | 0.49 | 11 | 5,739 | 17 | 6,569 | 8 |
| 31 | Tordisagar | Major | 0.87 | 30 | 1.50 | 30 | 13,960 | 5 | 9,793 | 29 |
| 32 | Udai Sagar | Medium | 0.73 | 33 | 1.22 | 27 | 4,650 | 19 | 11,411 | 33 |
| 33 | Ummedsagar | Medium | 1.51 | 21 | 0.67 | 17 | 2,968 | 29 | 9,690 | 28 |
| 34 | Vallabhnagar | Medium | 1.08 | 25 | 1.85 | 33 | 6,464 | 14 | 7,056 | 13 |
| 35 | Wagan | Medium | 2.67 | 10 | 0.60 | 14 | 8,270 | 10 | 6,569 | 7 |

# 10. Project's Prioritization

Long-term decisions by the Government of Rajasthan on investing in irrigation projects should be based on priority considerations, as well as budget and implementation capacity constraints. These considerations can be based on quantifiable as well as non-quantifiable attributes of the projects under consideration, and various persons or authorities, in considering their preferences, may assign different weights to the various attributes of the proposed projects.

The Consultants have developed a computational tool for multi-objective prioritization of projects, intended to enable ranking irrigation projects in an order of priorities according to a number of economic and other factors, or attributes, and according to different weights which can be assigned to these factors.

## 10.1 Prioritization factors

Prioritization is influenced by a number of quantifiable factors which determine the relative ranking of each factor (or attribute) in comparison to the rest of the irrigation projects.

These attributes that are taken into consideration within the prioritization model include economic, engineering and social consideration, which are calculated (or attributed) to each project separately according to the project's features.

The factors which affect the ranking include:

(i) Benefit-Cost (B/C) ratio.
rank number 1 = highest B/C ratio;

(ii) The cost of $m^3$ of water (total costs of supply).
rank number 1 = lowest cost of water;

(iii) Size of the culturable command area (CCA).

rank number 1 = highest value;

(iv) Present value of the total investments per hectare.
rank number 1 = lowest PV

(v) Present value of added water supply for priority sectors.
rank number 1 = highest percentage

(vi) Size of submergence area.
rank number 1 = lowest submergence

(vii) Age (years since the initial year of the project's commissioning).
rank number 1 = oldest project

(viii) Supply to disadvantaged social sectors, such as Scheduled Tribes (ST) and Scheduled Castes (SC).
rank number 0 = yes, if there is such a supply component in this project; otherwise = 1.

(ix) Supply to drought-prone areas (DPA).
rank number 0 = yes, if this is a DPA; otherwise = 1.

The rank order numbers of every quantifiable attribute within each of the project categories is given in order to indicate the place of the numerical value of that attribute

in the list of projects when this list is arranged in a descending or ascending order of the values of the attribute concerned (depending on the nature of the attribute), as described above.

Ultimately, the model generates a final priority list of projects according to the sum of the rank numbers multiplied by the weights assigned to the various attributes, which leads to the level of weights attribution to the prioritizing factors.

## 10.2 Weights attribution to prioritizing factors

In the prioritizing process a set of weights is attributed to the various prioritizing factors. The weights indicate the degree of importance each factor receives. While attributing weights there is a set of subjective considerations that affect the prioritization, which reflect the policy by which the prioritization is conducted. A different set of weights will determine a different ranking order of the projects. The prioritization hereby is determined according to two sets of weights, which reflect different considerations while ranking the projects. The two sets of weights reflect two policies or approaches, as described below:

(i) Economic benefit approach:

The set of weights gives greater weight (a value of "2") to the economic viability indicators: benefit-cost ratio, cost of water and PV of investments in the CCA. The other prioritizing factors receive a lower weight (a value of "1").

(ii) Social approach:

The set of weights gives a greater weight (a value of "2") to the social factors: PV of added supply for priority sectors, supply to disadvantaged social sectors and supply to drought-prone areas. The other prioritizing factors receive a lower weight (a value of "1").

Table 10.1 Sets of weights attribution to prioritizing factors

| Prioritizing Factor | Benefit /Cost | Cost of Water | CCA | PV of Investments per ha | PV of added supply for Priority Sectors | Submergence Area | Age | ST, SC 1=No 0=Yes | DPA 1=No 0=Yes |
|---|---|---|---|---|---|---|---|---|---|
| Set weights "A": Economic benefit approach | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Set weights "B": Social approach | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

Table 10.2 shows the rank number by attributes for the various projects analysed.

## 10.3 Prioritization

The model generates a final priority list of projects according to the sum of the rank numbers multiplied by the weights assigned to the various attributes and factors as shown in Table 10.3.

Table 10.2 Rank Numbers by Attributes Project Wise

| S. No. | Project | | Benefit/Cost | | Cost of Water | | CCA | | PV of Investments per ha) | | PV of added supply for Priority Sectors | | Submergence Area | | Age | | ST, SC 1=No 0=Yes | DPA 1=No 0=Yes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name | Class | Ratio | Rank | Rs./$m^3$ | Rank | ha | Rank | Rs. | Rank | $m^3$ | Rank | $km^2$ | Rank | Years | Rank | | |
| | Set weights "A": Economic benefit approach | | 2 | | 2 | | 1 | | 2 | | 1 | | 1 | | 1 | | 1 | 1 |
| | Set weights "B": Social approach | | 1 | | 1 | | 1 | | 1 | | 2 | | 1 | | 1 | | 2 | 2 |
| | A. Improvements in Existing Projects | | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Value |
| 1 | Arwar | Medium | 2.38 | 11 | 0.66 | 16 | 7,394 | 11 | 7,591 | 18 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 2 | Badgaon | Medium | 0.95 | 26 | 1.52 | 31 | 6,797 | 12 | 7,056 | 14 | 0 | 1 | 0 | 1 | 44 | 23 | 0 | 1 |
| 3 | Bagolia | Medium | 0.29 | 35 | 5.44 | 35 | 3,676 | 23 | 7,691 | 24 | 0 | 1 | 0 | 1 | 54 | 12 | 0 | 1 |
| 4 | Bassi | Medium | 3.86 | 1 | 0.40 | 5 | 3,250 | 26 | 6,202 | 4 | 0 | 1 | 0 | 1 | 24 | 32 | 0 | 1 |
| 5 | Bhupal sagar | Medium | 0.93 | 27 | 1.32 | 29 | 3,873 | 22 | 9,310 | 26 | 0 | 1 | 0 | 1 | 74 | 9 | 0 | 1 |
| 6 | Bilas | Medium | 2.34 | 12 | 0.38 | 4 | 5,863 | 16 | 5,725 | 3 | 0 | 1 | 0 | 1 | 15 | 35 | 0 | 1 |
| 7 | Chandrabhaga | Medium | 1.65 | 19 | 1.29 | 28 | 3,342 | 25 | 7,691 | 21 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 8 | Chandsain | Medium | 1.93 | 17 | 0.85 | 19 | 2,600 | 30 | 11,646 | 35 | 0 | 1 | 0 | 1 | 130 | 2 | 0 | 1 |
| 9 | Chaparwada | Major | 0.78 | 32 | 1.54 | 32 | 11,745 | 6 | 9,793 | 30 | 0 | 1 | 0 | 1 | 116 | 5 | 0 | 0 |
| 10 | Dheel | Medium | 1.25 | 22 | 1.00 | 25 | 5,943 | 15 | 9,950 | 31 | 0 | 1 | 0 | 1 | 99 | 7 | 0 | 1 |
| 11 | Dindoli | Medium | 2.96 | 6 | 0.64 | 15 | 2,056 | 34 | 7,146 | 16 | 0 | 1 | 0 | 1 | 45 | 22 | 0 | 1 |
| 12 | Dugari | Medium | 2.16 | 13 | 0.59 | 13 | 2,251 | 32 | 7,691 | 20 | 0 | 1 | 0 | 1 | 55 | 11 | 0 | 1 |
| 13 | Galwania | Medium | 3.64 | 2 | 0.53 | 12 | 2,257 | 31 | 8,289 | 25 | 0 | 1 | 0 | 1 | 56 | 10 | 0 | 1 |
| 14 | Gopalpura | Medium | 0.50 | 34 | 0.28 | 1 | 3,557 | 24 | 6,652 | 10 | 0 | 1 | 0 | 1 | 30 | 27 | 0 | 1 |
| 15 | Jaisamand | Major | 1.23 | 23 | 0.40 | 7 | 16,000 | 4 | 11,484 | 34 | 0 | 1 | 0 | 1 | 280 | 1 | 0 | 1 |
| 16 | Jakham | Major | 2.94 | 7 | 0.36 | 2 | 28,308 | 2 | 5,452 | 1 | 0 | 1 | 0 | 1 | 24 | 32 | 0 | 1 |
| 17 | Kalisil | Medium | 1.21 | 24 | 0.44 | 8 | 4,700 | 18 | 7,691 | 22 | 0 | 1 | 0 | 1 | 54 | 12 | 0 | 1 |
| 18 | Khari | Medium | 2.70 | 9 | 0.70 | 18 | 6,478 | 13 | 7,591 | 17 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 19 | Kothari | Medium | 2.73 | 8 | 0.46 | 9 | 4,395 | 20 | 6,202 | 5 | 0 | 1 | 0 | 1 | 21 | 34 | 0 | 1 |
| 20 | Lassadia | Medium | 3.27 | 4 | 0.48 | 10 | 2,080 | 33 | 6,652 | 9 | 0 | 1 | 0 | 1 | 30 | 27 | 0 | 1 |
| 21 | Madhosagar | Medium | 1.78 | 18 | 0.88 | 21 | 3,232 | 27 | 11,398 | 32 | 0 | 1 | 0 | 1 | 123 | 3 | 0 | 1 |
| 22 | Mahi Bajaj | Major | 2.14 | 15 | 0.40 | 6 | 80,000 | 1 | 9,464 | 27 | 0 | 1 | 0 | 1 | 27 | 30 | 0 | 1 |
| 23 | Mataji Ka Khera | Medium | 3.13 | 5 | 0.86 | 20 | 3,057 | 28 | 7,691 | 19 | 0 | 1 | 0 | 1 | 52 | 19 | 0 | 1 |
| 24 | Meja | Major | 1.53 | 20 | 1.07 | 26 | 20,714 | 3 | 6,693 | 12 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 25 | Murlia | Medium | 3.44 | 3 | 0.38 | 3 | 1,323 | 35 | 7,146 | 15 | 0 | 1 | 0 | 1 | 43 | 25 | 0 | 1 |
| 26 | Narain Sagar Jalia | Medium | 0.82 | 31 | 2.39 | 34 | 4,087 | 21 | 7,691 | 23 | 0 | 1 | 0 | 1 | 43 | 25 | 0 | 1 |
| 27 | Rajsamand | Major | 2.14 | 14 | 0.98 | 24 | 10,450 | 7 | 6,693 | 11 | 0 | 1 | 0 | 1 | 47 | 20 | 0 | 1 |
| 28 | Sardar Samand | Major | 1.95 | 16 | 0.91 | 22 | 10,325 | 8 | 6,448 | 6 | 0 | 1 | 0 | 1 | 106 | 6 | 0 | 0 |
| 29 | Sareri | Medium | 0.93 | 28 | 0.95 | 23 | 9,717 | 9 | 5,508 | 2 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 30 | Somkagdar | Medium | 0.88 | 29 | 0.49 | 11 | 5,739 | 17 | 6,569 | 8 | 0 | 1 | 0 | 1 | 27 | 30 | 0 | 1 |

| S. No. | Project | | Benefit/Cost | | Cost of Water | | CCA | | PV of Investments per ha) | | PV of added supply for Priority Sectors | | Submergence Area | | Age | | ST, SC 1=No 0=Yes | DPA 1=No 0=Yes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name | Class | Ratio | Rank | Rs./$m^3$ | Rank | ha | Rank | Rs. | Rank | $m^3$ | Rank | $km^2$ | Rank | Years | Rank | | |
| 31 | Tordi Sagar | Major | 0.87 | 30 | 1.50 | 30 | 13,960 | 5 | 9,793 | 29 | 0 | 1 | 0 | 1 | 122 | 4 | 0 | 1 |
| 32 | Udai Sagar | Medium | 0.73 | 33 | 1.22 | 27 | 4,650 | 19 | 11,411 | 33 | 0 | 1 | 0 | 1 | 46 | 21 | 0 | 1 |
| 33 | Ummed Sagar | Medium | 1.51 | 21 | 0.67 | 17 | 2,968 | 29 | 9,690 | 28 | 0 | 1 | 0 | 1 | 93 | 8 | 0 | 1 |
| 34 | Vallabhnagar | Medium | 1.08 | 25 | 1.85 | 33 | 6,464 | 14 | 7,056 | 13 | 0 | 1 | 0 | 1 | 44 | 23 | 0 | 1 |
| 35 | Wagan | Medium | 2.67 | 10 | 0.60 | 14 | 8,270 | 10 | 6,569 | 7 | 0 | 1 | 0 | 1 | 28 | 29 | 0 | 1 |

Table 10.3 Final ranking of project by two weights attribution approaches

| Project | Ranking Approach A | | | Ranking Approach B | | |
|---|---|---|---|---|---|---|
| | Priority-Summary A value | Rank A | Value / Average | Priority-Summary B value | Rank B | Value / Average |
| Arwar | 118 | 10 | 80.6% | 75 | 6 | 79.4% |
| Badgaon | 180 | 27 | 122.9% | 111 | 29 | 117.5% |
| Bagolia | 226 | 34 | 154.3% | 134 | 33 | 141.9% |
| Bassi | 81 | 2 | 55.3% | 73 | 3 | 77.3% |
| Bhupal sagar | 198 | 31 | 135.2% | 118 | 32 | 125.0% |
| Bilas | 92 | 3 | 62.8% | 75 | 7 | 79.4% |
| Chandrabhaga | 178 | 26 | 121.5% | 112 | 30 | 118.6% |
| Chandsain | 177 | 25 | 120.8% | 108 | 26 | 114.4% |
| Chaparwada | 201 | 32 | 137.2% | 108 | 28 | 114.4% |
| Dheel | 181 | 28 | 123.6% | 105 | 24 | 111.2% |
| Dindoli | 133 | 15 | 90.8% | 98 | 20 | 103.8% |
| Dugari | 138 | 19 | 94.2% | 94 | 18 | 99.5% |
| Galwania | 122 | 11 | 83.3% | 85 | 14 | 90.0% |
| Gopalpura | 144 | 21 | 98.3% | 101 | 22 | 107.0% |
| Jaisamand | 136 | 17 | 92.8% | 74 | 4 | 78.4% |
| Jakham | 57 | 1 | 38.9% | 49 | 1 | 51.9% |
| Kalisil | 141 | 20 | 96.3% | 89 | 17 | 94.3% |
| Khari | 118 | 9 | 80.6% | 76 | 8 | 80.5% |
| Kothari | 101 | 4 | 68.9% | 81 | 10 | 85.8% |
| Lassadia | 109 | 8 | 74.4% | 88 | 16 | 93.2% |
| Madhosagar | 175 | 24 | 119.5% | 106 | 25 | 112.3% |
| Mahi Bajaj | 130 | 13 | 88.7% | 84 | 13 | 89.0% |
| Mataji Ka Khera | 138 | 18 | 94.2% | 96 | 19 | 101.7% |
| Meja | 136 | 16 | 92.8% | 80 | 9 | 84.7% |
| Murlia | 105 | 7 | 71.7% | 86 | 15 | 91.1% |
| Narain Sagar Jalia | 225 | 33 | 153.6% | 139 | 35 | 147.2% |
| Rajsamand | 128 | 12 | 87.4% | 81 | 11 | 85.8% |
| Sardar Samand | 104 | 6 | 71.0% | 61 | 2 | 64.6% |
| Sareri | 132 | 14 | 90.1% | 81 | 12 | 85.8% |
| Somkagdar | 146 | 22 | 99.7% | 100 | 21 | 105.9% |
| Tordi Sager | 190 | 30 | 129.7% | 103 | 23 | 109.1% |
| Udai Sagar | 229 | 35 | 156.3% | 138 | 34 | 146.1% |
| Ummed Sagar | 172 | 23 | 117.4% | 108 | 27 | 114.4% |
| Vallabhnagar | 182 | 29 | 124.2% | 113 | 31 | 119.7% |
| Wagan | 104 | 5 | 71.0% | 75 | 5 | 79.4% |
| | | | | | | |
| **Average** | **146.5** | | | **94.4** | | |

## 11. Conclusion & Recommendation

1. An economic analysis of proposed rehabilitation works for 35 Major and Medium Irrigation projects has been carried out, of which 21 project have Benefit-Cost (B.C.) ratio more than 1.5 having Total Project Cost (Irrigation allocated project cost) Rs. 2,391.85 million and 4 projects have B.C. ratio between 1.5 and 1.0 and Total Project Cost (Irrigation allocated project cost) Rs. 475.54 million. The remaining 10 projects have B.C. ratio less than one and Total Project Capital Cost (Irrigation allocated project cost) is 848.22 million.
2. Rehabilitation of 25 Major / Medium Irrigation Projects on priority having B.C. ratio more than 1 as listed below:
   Arwar, Bassi, Bilas, Chandrabhaga, Chandsain, Dheel, Dindoli, Dugari, Galwania, Jaisamand (Udaipur), Jakham, Kalisil, Khari, Kothari, Lassadia, Madhosagar, Mahi Bajaj Sagar, Mataji Ka Khera, Meja, Murlia, Rajsamand, Sardar Samand, Ummed Sagar, Vallabhnagar, Wagan
3. Improvement in Reservoir operation database and measurement of evaporation losses.
4. Reservoirs should be resurveyed through latest techniques (like sonar survey) to assure latest area-capacity at various levels in order to consider the impact of siltation in reservoirs.
5. Formation of Water Users Associations (WUAs).
6. Promotion of Night irrigation to reduce field losses through evaporation.
7. Lining of field channels through WUAs.
8. Conjunctive use of water specially in command areas where water logging is observed and likely to occur. Also pressurized irrigation should be promoted in such areas.
9. Looking at the scarcity of water and reduced inflows to dams, it is recommended to adopt modern irrigation techniques i.e. conversion from flood irrigation to pressurized irrigation in existing as well as new projects and also in groundwater irrigated areas to control over-exploitation. GoR is also promoting pressurized irrigation and providing subsidy for it. In future as the demand for non-agriculture will increase, the pressurized irrigation has to be considered as a viable option to ensure present irrigated command and also not to effect the food production.
10. Based on the unit costs presented in Annex 1 of this report, the cost of conversion of surface water irrigated projects from flow to pressurized irrigation (as per Narmada project model) is Rs. 77,500 per ha, which means to convert about 41,84,000 ha CCA of all existing Major, Medium and Minor projects an investment (capital cost) of Rs. 32,426 Crores will be required and for which the approximate energy requirement will be 1046 MW. The energy cost will be extra. The conversion from flood irrigation to pressurized irrigation will result in increase in areas irrigated by surface water.

    Based on the unit costs presented in Annex 1 of this report, the cost of conversion of groundwater irrigated areas from flow to pressurized irrigation (as per Narmada project model) is Rs. 51,000 per ha, which means to convert about 43,38,000 ha (area irrigated by groundwater in 2009-10) an investment (capital cost) of Rs. 22,124 Crores will be required. Here the energy cost is not considered as it is already established in the field. However, the areas irrigated by groundwater should not be increased, so that it will reduce the groundwater pumping and will stabilize the ground water levels in long term.

Table 11.1 Action Plan based on Recommendations

| S. No. | Recommendations | Proposed Actions | Anticipated Value Addition | Responsibility |
|---|---|---|---|---|
| 1 | Rehabilitation of 25 Major / Medium Irrigation Projects listed below:<br>Arwar, Bassi, Bilas, Chandrabhaga, Chandsain, Dheel, Dindoli, Dugari, Galwania, Jaisamand (Udaipur), Jakham, Kalisil, Khari, Kothari, Lassadia, Madhosagar, Mahi Bajaj Sagar, Mataji Ka Khera, Meja, Murlia, Rajsamand, Sardar Samand, Ummed Sagar, Vallabhnagar, Wagan | Preparation of Detailed Project Reports for Rehabilitation of the listed 25 Major / Medium projects on priority.<br>(for details refer Section 9 of this report) | Improvement in irrigation efficiency, resulting in increased crop production. | SWRPD and WRD |
| 2 | Improvement in Reservoir operation database and measurement of evaporation losses. | Regular records of storages, water drawls for irrigation, crop grown in command areas, evaporation, seepage losses and spillage should be kept. In all the projects losses through evaporation should be measured regularly. | Updated database and proper records of reservoir operation for better water accounting. | SWRPD and WRD |
| 3 | Reservoirs should be resurveyed to assure latest area-capacity at various levels in order to consider the impact of siltation in reservoirs. | The elevation-area-capacity curves of reservoirs are not updated and may give wrong information on water availability, hence the reservoirs for Major / Medium dams should be resurveyed through latest techniques (like sonar survey) and the updated elevation-area-capacity curves / tables should be prepared and in future should be updated periodically. | Impact of siltation in reservoirs and corrected present capacity. | SWRPD and WRD |
| 4 | Formation of Water Users Associations. | WUAs (Water Users Associations) should be formed in all projects and encouraged to be actively involved in water allocation and distribution as well as proper outlets should be designed in order to ensure equity in respect of head, middle and tail reaches. | Equitable distribution of water, ownership resulting in improvement in operation and maintenance. | SWRPD and WRD |
| 5 | Promotion of Night irrigation to reduce field losses through evaporation | Night irrigation should be promoted to assure saving on operational loses below the outlets and improve upon field efficiency. | Reduction in on-farm losses through evaporation | SWRPD and WRD |

| S. No. | Recommendations | Proposed Actions | Anticipated Value Addition | Responsibility |
|---|---|---|---|---|
| 6 | Lining of field channels | Lining of field channels through WUAs. If conversion to pressurized irrigation is opted then lining of field channels is not required. | Better operation and maintenance due to ownership and reduction in seepage looses, resulting in less waterlogging along the canals and in the field. | SWRPD, WRD and WUAs |
| 7 | Conjunctive use of water | Conjunctive use of water especially in command areas where water logging is observed and likely to occur. Also pressurized irrigation should be promoted in such areas. | Improved water availability and reliability; reduction in water logging and consequently soil salinity. | SWRPD and WRD |
| 8 | Adoption of modern irrigation techniques | Looking at the scarcity of water and reduced inflows to dams, it is recommended to adopt modern irrigation techniques i.e. conversion from flood irrigation to pressurized irrigation in existing as well as new projects and also in groundwater irrigated areas to control over-exploitation. For surface water irrigated areas, conversion from flood irrigation to pressurized irrigation will result in increase in irrigated area. However, the areas irrigated by groundwater should not be increased, so that it will reduce the groundwater pumping and will stabilize the ground water levels in long term. GoR is also promoting pressurized irrigation and providing subsidy for it. A combined subsidy of 50% is provided by the Central and State Governments (Central: 40%, State: 10%) for sprinkler and drip irrigation systems. The Government of Rajasthan has taken an initiative to provide 20% additional subsidy for drip irrigation system. | Improved irrigation efficiency and crop yield. | SWRPD, WRD, RGWD and Rajasthan Agriculture Department |

# Annex 1
# Unit Cost Analysis

# Annex 1
# Unit Cost Analysis

## 1. Introduction

This annex describes the unit cost basis developed by the Consultants for the purpose of estimating the investments and operation costs of improvement plans, to be subjected to economic analysis and prioritization.

As a basis for estimating the cost of rehabilitation and modernization works required in existing irrigation projects, the Consultants have analysed the proposals, which have been formulated by the Irrigation Department in the framework of the Rajasthan Water Sector Restructuring Project (RWSRP). This analysis gave a set of unit costs per hectare of irrigation canal system and unit cost per $m^3$ for rehabilitation and modernization of dam (headwork).

## 2. Rehabilitation and Modernization

### 2.1 The RWSRP and JICA Projects

Table A1.1, A1.2 and A1.3 present a list of irrigation project, which are considered for rehabilitation and modernization under RWSRP and JICA. Table A1.1 shows the projects selected for canal and dam with large CCA of 2,280 to 38,671 ha with age from 50 to 123 years. Table A1.2 shows the projects selected for rehabilitation and modernization of dams (headwork) under RWSRP having gross capacity from 18.59 $Mm^3$ and 76.66 $Mm^3$ with age from 31 to 62 years. Table A1.3 shows district wise cost of dam and canal for rehabilitation of minor projects taken up under JICA.

Table A1.1 RWSRP Projects and Computed Unit Cost of Rehabilitation of Canal System

| S. No. | Project | River Basin | Year of Commiss-ioning | Age of Project in year 2010 | CCA (ha) | Cost of Improve-ment (Lac Rs.) | Year of estimate | Cost of Improve-ment at March 2010 (Lac Rs.) | Unit Cost (Rs./ha) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Juggar Bund | Gambhir | 1957 | 53 | 5,927 | 269.58 | 2000 | 473.11 | 7,982 |
| 2 | Morel Dausa | Banas | 1952 | 58 | 16,720 | 304.30 | 2000 | 534.05 | 3,194 |
| 3 | Surwal | Gambhir | 1954 | 56 | 4,130 | 145.96 | 2000 | 256.16 | 6,202 |
| 4 | Mora Sagar | Banas | 1934 | 76 | 7,374 | 294.25 | 2000 | 516.40 | 7,003 |
| 5 | Sainthalsagar | Banas | 1898 | 112 | 3,267 | 182.75 | 2000 | 320.72 | 9,817 |
| 6 | Mansarover | Chambal | 1957 | 53 | 3,168 | 149.02 | 2000 | 261.53 | 8,258 |
| 7 | Khared | Banganga | 1877 | 133 | 4,073 | 235.60 | 2000 | 413.48 | 10,152 |
| 8 | Chhitoli | Sabi | 1950 | 60 | 2,280 | 178.55 | 2000 | 313.30 | 13,741 |
| 9 | Kalakho | Banganga | 1953 | 57 | 3,400 | 179.64 | 2000 | 315.27 | 9,273 |
| 10 | Gudha | Chambal | 1958 | 52 | 11,367 | 1,174.59 | 2010 | 1,174.59 | 10,333 |
| 11 | Parbati | Parbati | 1963 | 47 | 25,368 | 1,669.35 | 2010 | 1,669.35 | 6,580 |
| 12 | Galwa | Banas | 1960 | 50 | 13,391 | 1,004.98 | 2010 | 1,004.98 | 7,505 |
| 13 | Orai | Banas | 1975 | 35 | 9,260 | 674.43 | 2010 | 674.43 | 7,283 |

Table A1.2 RWSRP Project and Computed Unit Cost for Rehabilitation of Dam

| S. No. | Project | Year of Comm-issioning | Age of Project year 2010 | Gross Capacity ($Mm^3$) | Cost, (Lac Rs.) | Year of estimate | Cost at March 2010 (Lac Rs.) | Cost, Lac Rs./$Mm^3$ | Unit Cost, Rs./$m^3$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Orai | 1975 | 35 | 35.29 | 1,353.00 | 2009 | 1,496.00 | 42.41 | 4.24 |
| 2 | Moral | 1984 | 58 | 76.66 | 2,257.00 | 2009 | 2,495.94 | 32.56 | 3.26 |
| 3 | Jetpura | 1978 | 32 | 18.54 | 998.00 | 2009 | 1,103.88 | 59.54 | 5.95 |
| 4 | Alnia | 1961 | 49 | 43.71 | 12.23 | 1998 | 2,461.00 | 56.29 | 5.63 |

Table A1.3 District-wise Cost of Rehabilitation of Projects and CCA covered under Various Projects Taken-up under JICA (Year 2010)

| S. No. | District | Total Number of Projects under Rehabilitation | CCA to be Rehabilitated under JICA, ha | Cost as per Contract, Lac Rs. | Unit Cost, Rs./ha |
|---|---|---|---|---|---|
| 1 | Ajmer | 28 | 3,763.70 | 770.36 | 20,468.16 |
| 2 | Tonk | 4 | 4,736.50 | 413.80 | 8,736.41 |
| 3 | Sawai Madhopur | 9 | 5,367.00 | 418.04 | 7,789.08 |
| 4 | Dausa | 3 | 4,774.00 | 724.59 | 15,177.84 |
| 5 | Karauli | 3 | 1,639.00 | 309.57 | 18,887.74 |
| 6 | Jaipur | 6 | 1,150.00 | 270.22 | 23,497.39 |
| 7 | Alwar | 2 | 1,794.00 | 215.62 | 12,018.95 |
| 8 | Pali | 20 | 9,453.00 | 1,268.71 | 13,421.24 |
| 9 | Sirohi | 13 | 7,580.00 | 1,072.90 | 14,154.35 |
| 10 | Barmer | 1 | 544.00 | 52.50 | 9,650.74 |
| 11 | Jalore | 1 | 112.00 | 31.74 | 28,339.29 |
| 12 | Bundi | 14 | 5,625.00 | 789.56 | 14,036.62 |
| 13 | Baran | 10 | 5,544.00 | 1,538.00 | 27,741.70 |
| 14 | Jhalawar | 6 | 2,788.00 | 557.62 | 20,000.72 |
| 15 | Banswara | 19 | 4,990.00 | 1,001.07 | 20,061.52 |
| 16 | Dungarpur | 17 | 4,005.00 | 643.38 | 16,064.42 |
| 17 | Bhilwara | 9 | 7,348.00 | 1,267.06 | 17,243.60 |
| 18 | Chittorgarh | 20 | 6,536.00 | 901.93 | 13,799.42 |
| 19 | Rajsamand | 19 | 5,181.00 | 795.10 | 15,346.46 |
| 20 | Udaipur | 4 | 1,378.00 | 228.37 | 16,572.57 |
| 21 | Salumber | 9 | 3,671.00 | 1,065.40 | 29,022.06 |
| | Average | | 4,189.49 | 682.64 | 17,239.54 |

Source: Physical & Financial Progress of Rehabilitation of Sub-project (Rajasthan Minor Irrigation Project)

While reviewing the RWSRP project reports, it was observed that some of these have been analysed in great detail, and cost estimates prepared in a fairly detailed manner while in other cases the estimates are based on lump-sum unit cost basis for entire components such as regulating structures, cross-drainage works, restructuring and remodelling of canals, etc.; such estimating do not appear to be reliable, considering the age the project, the necessary improvements and various other factors. It was therefore decided to select as a basis for evaluating unit cost only those projects where detailed estimates had been prepared. The cost estimate prepared for the various RWSRP

projects are given in price terms varying between years 2000 and 2010. These have been adjusted to bring all the costs to the year 2010 price level, using the escalation factors, as summarised in Table A1.4.

Table A1.4 Summary of Unit Cost estimates for Canal Rehabilitation

| S. No. | Class and Name of Project | Age in Year at end of 2010 | CCA (ha) | Unit Cost (Rs./ha) | | |
|---|---|---|---|---|---|---|
| | | | | As per RWSRP | Year of Estimate | At March 2010 Price |
| (i) | 2,000 to 5,000 ha of CCA | | | | | |
| | Mansarover | 53 | 3,168 | 4,704 | 2000 | 8,258 |
| | Kalakho | 57 | 3,450 | 5,284 | 2000 | 9,273 |
| (ii) | 5,000 to 10,000 ha | | | | | |
| | Juggar bund | 53 | 5,927 | 4,548 | 2000 | 7,982 |
| | Orai | 35 | 9,260 | 7,283 | 2010 | 7,283 |
| (iii) | 10,000 to 50,000 ha | | | | | |
| | Parbati | 47 | 25,368 | 6,580 | 2010 | 6,580 |
| | Galwa | 50 | 13,391 | 7,505 | 2010 | 7,505 |

## 2.2 Applying Unit Cost Derived from RWSRP Studies

### *2.2.1 Cost Escalation*

The cost estimates prepared for the various JICA and RWSRP projects and existing on-going projects reflect price term varying between year 2000 to 2010; these have been converted to a uniform price level of end of financial year 2009-10 i.e. March 2010 by using escalation factor derived from two price index data (published by the GOI and other financial institutions), namely:

India- wholesale price index (WPI) (Base 2005 = 100)

All India consumer price index (CPI) (general) for industrial workers (Base 1982 =100)

The WPI and CPI escalation factors were derived by dividing the WPI and the CPI for year ending March 2010 by the WPI and the CPI of the year for which the factor is to be worked out; then, the escalation factor to be used was calculated by giving 60% weight to WPI and 40% weight to CPI, assuming that the average ratio of material and labour inputs in irrigation project is 60:40. This procedure gives the escalation factors as shown in Table A1.5.

Table A1.5 Project cost Escalation Factors Based on WPI and CPI

| Year | WPI | WPI Escalation Factor | CPI | CPI Escalation Factor | Weighted Escalation Factor |
|---|---|---|---|---|---|
| 1997 | 67.70 | 1.978 | 358 | 2.277 | 2.097 |
| 1998 | 71.75 | 1.866 | 405 | 2.012 | 1.924 |
| 1999 | 74.22 | 1.804 | 424 | 1.922 | 1.851 |
| 2000 | 79.09 | 1.693 | 441 | 1.848 | 1.755 |
| 2001 | 82.90 | 1.615 | 458 | 1.779 | 1.681 |
| 2002 | 84.99 | 1.575 | 477 | 1.709 | 1.629 |
| 2003 | 89.60 | 1.494 | 496 | 1.643 | 1.554 |
| 2004 | 95.49 | 1.402 | 514 | 1.586 | 1.475 |

| Year | WPI | WPI Escalation Factor | CPI | CPI Escalation Factor | Weighted Escalation Factor |
|---|---|---|---|---|---|
| 2005 | 100.00 | 1.339 | 536 | 1.521 | 1.411 |
| 2006 | 104.74 | 1.278 | 569 | 1.432 | 1.340 |
| 2007 | 109.85 | 1.219 | 606 | 1.345 | 1.269 |
| 2008 | 119.39 | 1.121 | 656 | 1.242 | 1.170 |
| 2009 | 122.20 | 1.096 | 727 | 1.121 | 1.106 |
| 2010 | 133.88 | 1.000 | 815 | 1.000 | 1.000 |

### *2.2.2 Extrapolating to All Existing Projects Requiring Rehabilitation and Modernization*

Since the CCA and age of the RWSRP projects vary considerably, a normative approach has been adopted for applying unit costs for rehabilitation and modernization. It was felt that all the projects commissioned prior to the year 1995 generally require rehabilitation and modernization, but that consideration should also be given to the different age of the projects. The unit costs derived from the RWSRP studies were thus increased to reflect the age of the project by year 1995.

For this purpose it was suggested to assume a 1% annual increase in the cost of required rehabilitation and modernization works, relative to the estimates based on the RWSRP and JICA studies for every year prior to 1995 up to year 1935.The annual increase rate was reduced to 0.5% per year beyond 1935. This gives the decadal increased cost factors shown in Table A1.6.

Table A1.6 Rehabilitation Cost Increase Factors

| Decade | Increased Cost Factor |
|---|---|
| 1995-2009 | 1.00 |
| 1985-1994 | 1.10 |
| 1975-1984 | 1.20 |
| 1965-1974 | 1.30 |
| 1955-1964 | 1.40 |
| 1945-1954 | 1.50 |
| 1935-1944 | 1.60 |
| 1925-1934 | 1.65 |
| 1915-1924 | 1.70 |
| 1905-1914 | 1.75 |
| 1895-1904 | 1.80 |
| 1885-1894 | 1.85 |
| 1875-1884 | 1.90 |

The cost of rehabilitation and modernization for canal system of selected RWSRP projects have been converted to the base year 1995 on this basis as given in Table A1.7.

Table A1.7 RWSRP Project Adjusted, 1995 Canal Rehabilitation

| Project | Unit cost Rs./ha | Year of Commissioning | Cost of base year 1995 |
|---|---|---|---|
| 2000 to 5000 ha | | | |
| Mansarover | 8,258 | 1957 | 5,899 |
| Kalakho | 9,273 | 1953 | 6,182 |
| | | Average | 6,040 (Say 6,000) |
| 5000 to 10000 ha | | | |
| Juggar bund | 7,982 | 1957 | 5,701 |
| Orai | 7,283 | 1975 | 6,069 |
| | | Average | 5,885 (Say 5,900) |
| 10000 to 50000 ha | | | |
| Parbati | 6,580 | 1963 | 4,700 |
| Galwa | 7,505 | 1960 | 5,361 |
| | | Average | 5,030 (say 5,000) |

Thus, the normative unit costs applicable to canal systems adjusted by the decadal cost increase factors have been worked out as given in Table A1.8.

Table A1.8 Normative Unit Rehabilitation Cost for Canal System by Decade of Project Age

| Year | Cost (Rs./ha) | | |
|---|---|---|---|
| | 2,000-5,000, ha | 5,000-10,000, ha | Above 10,000, ha |
| 1995-2009 | 6,000 | 5,900 | 5,000 |
| 1985-1994 | 6,600 | 6,490 | 5,500 |
| 1975-1984 | 7,260 | 7,139 | 6,050 |
| 1965-1974 | 7,986 | 7,853 | 6,655 |
| 1955-1964 | 8,785 | 8,638 | 7,321 |
| 1945-1954 | 9,663 | 9,502 | 8,053 |
| 1935-1944 | 10,629 | 10,452 | 8,858 |
| 1925-1934 | 11,161 | 10,975 | 9,301 |
| 1915-1924 | 11,719 | 11,524 | 9,766 |
| 1905-1914 | 12,305 | 12,100 | 10,254 |
| 1895-1904 | 12,920 | 12,705 | 10,767 |
| 1885-1894 | 13,566 | 13,340 | 11,305 |
| 1875-1884 | 14,244 | 14,007 | 11,870 |

Applying these unit costs to the selected RWSRP project produces results as presented in Table A1.9.

Table A1.9 RWSRP Project Cost Estimates (Canal work) Adjusted by the Normative Approach

| Class and Name of Project | CCA, ha | Year of Commissioning | Cost at 2010, Rs./ha | Normative Cost, Rs./ha | Variance |
|---|---|---|---|---|---|
| 2,000 to 5,000 ha | | | | | |
| Mansarover | 3,168 | 1957 | 8,258 | 8,784 | 6.37% |
| Kalakho | 3,400 | 1953 | 9,273 | 9,663 | 4.21% |
| 5,000 to 10,000 ha | | | | | |
| Juggar bund | 5,927 | 1958 | 7,982 | 8,345 | 4.55% |
| Orai | 9,260 | 1975 | 7,283 | 6,897 | -5.30% |
| Above 10,000 ha | | | | | |
| Parbati | 25,368 | 1963 | 6,580 | 7,320 | 11.25% |
| Galwa | 13,391 | 1960 | 7,505 | 7,320 | -2.47% |

It can be seen that the applied unit rates of rehabilitation canal system for projected constructed prior to 1995 the difference between the normative approach costs and the RWSRP cost for selected projects (estimate of which are considered reliable) is within +10%, except Parbati which is slightly higher by about 1% more.

Similar to canal system, existing projects which require rehabilitation and modernization of headworks when extrapolated by age the cost vary considerably compared with RWSRP as demonstrated in Table A1.10.

Table A1.10 Cost of Rehabilitation and Modernization of Headworks Dam (Medium Project Cost)

| Project | Gross Storage $Mm^3$ | Unit cost, $Rs./m^3$ | Year of Commissioning | Base Year 1995 Cost, $Rs./m^3$ |
|---|---|---|---|---|
| Up to 25 $Mm^3$ | | | | |
| Jetpura | 18.54 | 5.95 | 1978 | 4.96 |
| 25 to 50 $Mm^3$ | | | | |
| Orai | 35.28 | 4.24 | 1975 | 3.53 |
| Alnia | 43.71 | 5.63 | 1961 | 4.02 |
| 50 $Mm^3$ and above | | | | 3.78 |
| Moral | 76.62 | 3.26 | 1984 | 2.72 |

Accordingly, the normative cost applied to the said categories has been projected and adjusted by the above-mentioned decadal cost increase factors as given in Table A1.11.

Table A1.11 Adjusted Normative Unit Cost for Rehabilitation of Dam Systems

| Year | up to 20 $Mm^3$ | 20 to 35 $Mm^3$ | 35 $Mm^3$ and Above |
|---|---|---|---|
| | ($Rs./m^3$) | | |
| 1995 - 2009 | 4.95 | 3.78 | 2.72 |
| 1985 - 1994 | 5.45 | 4.16 | 2.99 |
| 1975 - 1984 | 5.99 | 4.57 | 3.29 |
| 1965 - 1974 | 6.59 | 5.03 | 3.62 |
| 1955 - 1964 | 7.25 | 5.53 | 3.98 |
| 1945 - 1954 | 7.97 | 6.09 | 4.38 |
| 1935 - 1944 | 8.77 | 6.69 | 4.82 |
| 1925 - 1934 | 9.21 | 7.02 | 5.06 |

| Year | up to 20 $Mm^3$ | 20 to 35 $Mm^3$ | 35 $Mm^3$ and Above |
|---|---|---|---|
| | ($Rs./m^3$) | | |
| 1915 - 1924 | 9.67 | 7.38 | 5.31 |
| 1905 - 1914 | 10.15 | 7.74 | 5.58 |
| 1895 - 1904 | 10.66 | 8.13 | 5.86 |
| 1885 - 1894 | 11.19 | 8.54 | 6.15 |
| 1875 - 1884 | 11.75 | 8.96 | 6.46 |

Applying these unit costs to selected RWSRP projects produces results as presented in Table A1.12.

Table A1.12 Adjusted Normative Cost Estimate for Selected RWSRP Headwork Projects

| Project | Gross Storage ($Mm^3$) | Year of Commissioning | Cost at 2010 ($Rs./m^3$) | Normative Cost ($Rs./m^3$) | Variance |
|---|---|---|---|---|---|
| Jetpura | 18.54 | 1978 | 5.95 | 5.99 | 0.67% |
| Orai | 35.28 | 1975 | 4.24 | 4.57 | 7.78% |
| Alnia | 43.71 | 1961 | 5.63 | 5.53 | -1.78% |
| Moral | 76.62 | 1984 | 3.26 | 3.29 | 0.92% |

As seen, the variance between the normative approach cost and RWSRP cost for the selected project is within +10%, therefore the given unit cost for rehabilitation of dams prior has been taken as basis of estimate.

The cost of modernization and rehabilitation of minor projects having CCA of less than 2,000 ha (227 projects) as per district-wise estimates prepared under JICA can be adopted which works out to average cost of Rs. 17,240/ha, say, Rs. 17,500/ha at year 2010. This cost can be applied for all the minor projects throughout the State.

## 2.3 Cost of On-Farm Improvements

The above costs do not include land development works necessary to improve on-farm irrigation efficiency. These works include repair and remodelling of watercourses and field channels, and some land levelling.

Where required, field channels and watercourses are maintained by farmers. However, cost of repair and remodelling of water courses have been estimated by the Irrigation Department for the command area of existing projects within the command of the on-going Bisalpur Project. These work out to 830 Rs./ha, including the cost of adjustable proportional module (APM), water distribution structures at a cost of 148.50 Rs./ha, which are included in the estimates presented in the RWSRP studies. Thus the cost of repair and remodelling of water channels alone is (830-148.50=) 681.50 Rs./ha. This is based on 1991 price levels. Allowing for price escalation, the cost at 2010 price level works out at 2,382, say 2500 Rs./ha.

It is very important to have levelled fields for efficient application of water, fertilizers, etc., and to assure a uniform growth of crops in the field. Since in most of the areas, the land holdings are small, the levelling and formation of small plots as necessary for efficient irrigation can be done by farmers with their own animal labour. In some areas, mechanical means may however be necessary for land levelling, for which a general provision of 1,500 Rs./ha is proposed to be made.

Thus, the following unit costs are recommended to be adopted:

Improvement of watercourses and field channels: 2,500 Rs./ha.

Land levelling: 1,500 Rs./ha.

# 3. Cost of Canal System in Additional Command Areas

## 3.1 Unlined Canals

As shown above, the overall cost per ha of a medium irrigation project with unlined canal system (only selective lining in critical sections) averages 178,000 Rs./ha, and the cost per $m^3$ of storage in medium projects is 26 Rs./$m^3$. Taking 5,000 $m^3$ as an average water requirement per ha of CCA, the cost of storage per ha works out as (5,000*26=) Rs. 130,000, and the balance unit cost for an unlined canal system is (178,000-130,000=) 48,000 Rs./ha. To express the variation in the cost per ha of canal systems according to the size of the project, a factor of 0.95 was applied for projects having a CCA of between 7,000 and 10,000 ha, and a factor of 1.05 was applied to projects having a CCA of 2,000 to 4,000 ha.

## 3.2 Lined Canals

The cost of lined canal systems in plain areas may be taken as 64,000 Rs./ha, as shown in the Table A1.17.

Table A1.17 Cost of Lined Canal System

| S. No. | Project | CCA (ha) | Total Cost of Canal System at 2010 Prices (Million Rs.) | Unit Cost (Rs./ha) |
|---|---|---|---|---|
| 1 | Narmada Project | 246,000 | 11,284 | 45,870 |
| 2 | Manohar Thana | 9,834 | 858 | 87,208 |
| 3 | Rajgarh | 6,827 | 403 | 59,011 |
| | Average | | | 64,030 |

The same adjustment factors suggested above (Para. 3.1) for unlined canal systems were also applied in estimating the cost of lined canal systems.

## 3.3 On Farm Development Work

According to Bisalpur Project estimates, the cost per ha of watercourses is Rs. 11,500 at 2009 prices. Adding price escalation, the March 2010 cost works out as 12,700 Rs./ha and as per guidelines issued on command area development and water management programme by CADA/ MOWR GOI the cost per ha. On farm development (which is comprising of construction of water courses/ field channels, Land levelling and Realignment of field boundaries where necessary) has been kept as Rs. 15000/- per ha. Therefore the same (Rs. 15000/- per ha.) cost can be considered representative for the basins in eastern Rajasthan. In western Rajasthan basins, where, because of the prevailing types of soil and the adverse topographical conditions, watercourses are lined and have much larger discharge capacities, as result of which the cost of construction of water courses/ field channels, Land levelling and Realignment of field boundaries where necessary has been kept as Rs.22,000 per guidelines issued on command area development and water management programme by CADA/ MOWR GOI

### 3.4 Total

The total cost of extending an unlined canal system to additional command area of an existing irrigation project, and of constructing new projects, subject to the adjustment factors described above, amount to values as given in Table A1.18 and A1.19 for unlined and lined canals, respectively.

Table A1.18 Total Estimated Cost of Extending Unlined Canal System

| Component | Unit Cost (Rs./ha) |
|---|---|
| Canals | 48,000 |
| On Farm Development works | 15000 |
| **Total** | **63000** |

Table A1.19 Total Estimated Cost of Extending Lined Canal System

| Component | Unit Cost (Rs./ha) |
|---|---|
| Canals | 64,000 |
| On Farm Development works | 22000 |
| **Total** | **86000** |

## 4. Wells

### 4.1 Dug Wells

The unit of dug wells was calculated on the basis of 2010 BSR of special schemes organization (GOR), according to which the average cost of dug wells per m depth is Rs. 3570 in alluvium of 2.5 m diameter well and Rs. 4250 in hard rock having 3.5 m diameter well.

### 4.2 Drilled Wells

The unit cost of drilled wells is based on a letter issued on 10/10/2005 by Ex. Engineer, Rajasthan Ground Water Department, and Circular No. SEDM/I (1) 95-96/159, dated 1.3.96 by the Public Health Engineering Department (PHED), GoR giving the following rates, in Rs./m:

| Item | Unit | Drilling cost in Rs./m for various diameters (Dia.) | | | | |
|---|---|---|---|---|---|---|
| | | In Hard Rock | | | In Alluvium | |
| | | 110-115 mm Dia. | 150 mm Dia. | 175-200 mm Dia. | 200-250 mm Dia., Rotary Rig | 250-300 mm Dia., Percussion Rig |
| Drilling | Rs./m | 270 | 449 | 627 | 1238 | 2115 |
| Assembly / Casing* | Rs./m | 274 | 728 | 980 | 1112 | - |
| Additional Charge & DCB | Rs./m | 500 | 700 | - | - | - |

* In hard rock casing has been considered for 10m.

These costs do not include well development & assembly lowery including gravel pack, which has been taken as Rs. 495/m.

For planning purpose it was assumed that the depth of well would be 80% of the average depth to basement in the project command area. The drawdown has been considered as 40 m in hard rock and 25 m in alluvial aquifer below the observed pre-monsoon 2010 water table.

### 4.3 Pumping Equipment

The capital cost of pumping equipment for wells was calculated at a rate of 9000 Rs /hp on the basis of prevailing market rates.

## 5. Operation and Maintenance

Annual O&M costs related to irrigation projects were computed on the basis of the following rates, related to capital costs or to unit area, as follows:

| | |
|---|---|
| Headworks - | 1% |
| Pumps - | 5% |
| Standby pumps - | 2.5% |
| Pipeline - | 3% |
| Canal systems - | Rs. 564.00 per ha |
| Water course - | Rs. 312 per ha |

Sources of information used for these figures are as follows:

- Maintenance of canal systems – As per estimate of Narmada canal Rs. 1387 lac has been taken as project maintenance for 2.46 lac ha area. The O&M charges of canal system works out as 563.8 per ha.
- Maintenance of water courses – as taken in Bisalpur project (2009), at 1% of the capital cost, or Rs. 28261 per ha, which, in price terms of March 2010 amounts to 28261 x 1.106 x 0.01 Rs. say 312.

## 6. Groundwater Pumping Costs

### 6.1 Energy

Electrical energy required for pumping, in kWh $= \frac{W \times Q \times h \times 0.746}{75 \times \eta \times 3600}$ where

Q = Volume of Water in $m^3$

h = head, in m

W = weight of water (1000 kg/$m^3$)

$\eta$ = product pump and motor efficiency, taken as 75% and 90%, respectively.

With these assumptions the electrical energy required works out to $\frac{Qh}{244.3}$, say $\frac{Qh}{250}$.

### 6.2 O&M

The O&M cost of pumping by wells has been worked out to cover its operation and maintenance and the electricity costs.

Maintenance costs were taken as 5% of the capital cost of the pumping equipment and accessories. Electricity costs has been taken as Rs. 2.31 per kWh (which includes Rs. 0.04 per kWh as tax and Rs. 0.02 per kWh as permanent fee), which is the unsubsidized rate of electricity for agriculture, at March 2010 price level, based on Rajasthan State Electricity Board Rates.

Hence, the cost of pumping a unit volume of water ($m^3$) is Rs. $\frac{2.31 \times 1 \times h}{250}$ **i. e. Rs.** $\frac{h}{108}$.

## 6.3 Present Groundwater Scenario

The present (2010) groundwater scenario in the project command area of 35 Irrigation projects identified for detailed study is given below.

| S. No. | Project | Stage of Groundwater Development in Project Command Area | Pre-monsoon 2010 depth to water table, m bgl | Head of pumping, m |
|---|---|---|---|---|
| 1 | Arwar | 245.56% | 11.67 | 51.67 |
| 2 | Badgaon | 217.85% | 21.82 | 61.82 |
| 3 | Bagolia | 207.53% | 19.19 | 59.19 |
| 4 | Bassi | 112.08% | 11.02 | 51.02 |
| 5 | Bhupalsagar | 75.15% | 13.78 | 53.78 |
| 6 | Bilas | 138.33% | 13.37 | 53.37 |
| 7 | Chandra Bhaga | 207.15% | 16.12 | 56.12 |
| 8 | Chandsen Bheru Sagar | 59.66% | 14.41 | 54.41 |
| 9 | Chaparwara | 97.13% | 12.83 | 52.83 |
| 10 | Dheel | 153.13% | 18.25 | 58.25 |
| 11 | Dindoli | 172.94% | 26.13 | 66.13 |
| 12 | Dugari | 59.89% | 17.14 | 57.14 |
| 13 | Galwania | 78.55% | 17.25 | 57.25 |
| 14 | Gopalpura | 55.07% | 10.82 | 50.82 |
| 15 | Jaisamand | 83.45% | 9.08 | 49.08 |
| 16 | Jakham | 81.39% | 7.22 | 47.22 |
| 17 | Kalisil | 167.43% | 21.31 | 61.31 |
| 18 | Khari | 263.44% | 22.44 | 62.44 |
| 19 | Kothari Dam | 148.54% | 15.05 | 55.05 |
| 20 | Lassariya | 234.43% | 11.25 | 51.25 |
| 21 | Madho Sagar | 138.20% | 41.73 | 81.73 |
| 22 | Mahi Bajaj Sagar | 36.22% | 6.60 | 46.60 |
| 23 | Mataji Ka Khera | 109.41% | 18.30 | 58.30 |
| 24 | Meja | 254.38% | 15.61 | 55.61 |
| 25 | Murlia | 225.47% | 10.35 | 50.35 |
| 26 | Narayan Sagar | 245.63% | 17.47 | 57.47 |
| 27 | Rajsamand | 152.88% | 19.14 | 59.14 |
| 28 | Sardar Samand | 19.87% | 9.30 | 49.30 |
| 29 | Sareri | 122.82% | 16.03 | 56.03 |
| 30 | Som Kagdar | 35.44% | 8.27 | 48.27 |
| 31 | Tordi Sagar | 83.11% | 15.85 | 55.85 |
| 32 | Udai Sagar | 141.65% | 14.05 | 54.05 |
| 33 | Ummed Sagar (Bhilwara) | 147.29% | 8.97 | 48.97 |
| 34 | Vallabhnagar | 184.78% | 13.84 | 53.84 |
| 35 | Wagon Project | 178.72% | 17.45 | 57.45 |

# 7. Sprinkler System

## 7.1 Unit Cost of Sprinkler System for 100 ha

In most of the irrigation projects command area is under gravity flow and irrigation is being applied to crops through surface method which is older and most common. In this system the water is directly applied to the soil surface from channel or an open ditch at top end of the land. In the system significant losses occur due to percolation and soil evaporation which leads to very low irrigation application efficiency. Therefore, it is proposed that in place of surface (flooding) method Sprinkler system should be introduced to increase irrigation application efficiency. The Unit cost of Sprinkler system for 100 ha was estimated in Narmada project which includes cost of diggie, pump room, sump wells, HDPE pipe network, pumps, motors, nozzles etc. and cost of system was estimated as Rs. 69,960 /ha as per 2009 price level. After adding escalation, the cost at 2010 price level work out as Rs. 77,376 say Rs. 77,500 /ha.

**Abstract of cost for 100 ha plot**

| S. No. | Items | Amount in Rs. (2009 price level) |
|---|---|---|
| 1 | Diggies | 615,154 |
| 2 | Pump Rooms & Boundary wall | 614,240 |
| 3 | Sump Wells | 128,155 |
| 4 | HDPE Pipe Network | 1,083,000 |
| 5 | Pumps and Motors | 424,300 |
| 6 | Cost of Pipeline | 2,700,000 |
| 7 | Cost of Nozzles | 800,000 |
| | **Total** | **6,364,849** |
| | Rate for 100 ha | 6,364,849 |
| | Rate per ha | 63,648 |
| | Add 10% for electricity transmission and connection | 6,365 |
| | Total Rate per ha, Rs. | 70,013 |
| | Add escalation for 2010 @ 10.6% | 7,421 |
| | Total Rs. | 77,434 |
| | **Say Rs.** | **77,500 per ha** |

**Abstract of cost for 100 ha plot if the source is existing well using groundwater:**

| S. No. | Items | Amount in Rs. (2009 price level) |
|---|---|---|
| 1 | HDPE Pipe Network | 1,083,000 |
| 2 | Cost of Pipeline | 2,700,000 |
| 3 | Cost of Nozzles | 800,000 |
| | **Total** | **4,583,000** |
| | Rate for 100 ha | 4,583,000 |
| | Rate per ha | 45,830 |
| | Add escalation for 2010 @ 10.6% | 4,858 |
| | Total Rs. | 50,688 |
| | **Say Rs.** | **51,000 per ha** |

## 7.2 Energy Requirement

Energy requirement @ 25 kW per diggi has been considered in Narmada project accordingly, for 100 ha the energy requirement is 25 kW.

# Annex 1
# Unit Cost Analysis

# Annex 1
# Unit Cost Analysis

## 1. Introduction

This annex describes the unit cost basis developed by the Consultants for the purpose of estimating the investments and operation costs of improvement plans, to be subjected to economic analysis and prioritization.

As a basis for estimating the cost of rehabilitation and modernization works required in existing irrigation projects, the Consultants have analysed the proposals, which have been formulated by the Irrigation Department in the framework of the Rajasthan Water Sector Restructuring Project (RWSRP). This analysis gave a set of unit costs per hectare of irrigation canal system and unit cost per $m^3$ for rehabilitation and modernization of dam (headwork).

## 2. Rehabilitation and Modernization

### 2.1 The RWSRP and JICA Projects

Table A1.1, A1.2 and A1.3 present a list of irrigation project, which are considered for rehabilitation and modernization under RWSRP and JICA. Table A1.1 shows the projects selected for canal and dam with large CCA of 2,280 to 38,671 ha with age from 50 to 123 years. Table A1.2 shows the projects selected for rehabilitation and modernization of dams (headwork) under RWSRP having gross capacity from 18.59 $Mm^3$ and 76.66 $Mm^3$ with age from 31 to 62 years. Table A1.3 shows district wise cost of dam and canal for rehabilitation of minor projects taken up under JICA.

Table A1.1 RWSRP Projects and Computed Unit Cost of Rehabilitation of Canal System

| S. No. | Project | River Basin | Year of Commiss-ioning | Age of Project in year 2010 | CCA (ha) | Cost of Improve-ment (Lac Rs.) | Year of estimate | Cost of Improve-ment at March 2010 (Lac Rs.) | Unit Cost (Rs./ha) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Juggar Bund | Gambhir | 1957 | 53 | 5,927 | 269.58 | 2000 | 473.11 | 7,982 |
| 2 | Morel Dausa | Banas | 1952 | 58 | 16,720 | 304.30 | 2000 | 534.05 | 3,194 |
| 3 | Surwal | Gambhir | 1954 | 56 | 4,130 | 145.96 | 2000 | 256.16 | 6,202 |
| 4 | Mora Sagar | Banas | 1934 | 76 | 7,374 | 294.25 | 2000 | 516.40 | 7,003 |
| 5 | Sainthalsagar | Banas | 1898 | 112 | 3,267 | 182.75 | 2000 | 320.72 | 9,817 |
| 6 | Mansarover | Chambal | 1957 | 53 | 3,168 | 149.02 | 2000 | 261.53 | 8,258 |
| 7 | Khared | Banganga | 1877 | 133 | 4,073 | 235.60 | 2000 | 413.48 | 10,152 |
| 8 | Chhitoli | Sabi | 1950 | 60 | 2,280 | 178.55 | 2000 | 313.30 | 13,741 |
| 9 | Kalakho | Banganga | 1953 | 57 | 3,400 | 179.64 | 2000 | 315.27 | 9,273 |
| 10 | Gudha | Chambal | 1958 | 52 | 11,367 | 1,174.59 | 2010 | 1,174.59 | 10,333 |
| 11 | Parbati | Parbati | 1963 | 47 | 25,368 | 1,669.35 | 2010 | 1,669.35 | 6,580 |
| 12 | Galwa | Banas | 1960 | 50 | 13,391 | 1,004.98 | 2010 | 1,004.98 | 7,505 |
| 13 | Orai | Banas | 1975 | 35 | 9,260 | 674.43 | 2010 | 674.43 | 7,283 |

Table A1.2 RWSRP Project and Computed Unit Cost for Rehabilitation of Dam

| S. No. | Project | Year of Comm-issioning | Age of Project year 2010 | Gross Capacity ($Mm^3$) | Cost, (Lac Rs.) | Year of estimate | Cost at March 2010 (Lac Rs.) | Cost, Lac Rs./$Mm^3$ | Unit Cost, Rs./$m^3$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Orai | 1975 | 35 | 35.29 | 1,353.00 | 2009 | 1,496.00 | 42.41 | 4.24 |
| 2 | Moral | 1984 | 58 | 76.66 | 2,257.00 | 2009 | 2,495.94 | 32.56 | 3.26 |
| 3 | Jetpura | 1978 | 32 | 18.54 | 998.00 | 2009 | 1,103.88 | 59.54 | 5.95 |
| 4 | Alnia | 1961 | 49 | 43.71 | 12.23 | 1998 | 2,461.00 | 56.29 | 5.63 |

Table A1.3 District-wise Cost of Rehabilitation of Projects and CCA covered under Various Projects Taken-up under JICA (Year 2010)

| S. No. | District | Total Number of Projects under Rehabilitation | CCA to be Rehabilitated under JICA, ha | Cost as per Contract, Lac Rs. | Unit Cost, Rs./ha |
|---|---|---|---|---|---|
| 1 | Ajmer | 28 | 3,763.70 | 770.36 | 20,468.16 |
| 2 | Tonk | 4 | 4,736.50 | 413.80 | 8,736.41 |
| 3 | Sawai Madhopur | 9 | 5,367.00 | 418.04 | 7,789.08 |
| 4 | Dausa | 3 | 4,774.00 | 724.59 | 15,177.84 |
| 5 | Karauli | 3 | 1,639.00 | 309.57 | 18,887.74 |
| 6 | Jaipur | 6 | 1,150.00 | 270.22 | 23,497.39 |
| 7 | Alwar | 2 | 1,794.00 | 215.62 | 12,018.95 |
| 8 | Pali | 20 | 9,453.00 | 1,268.71 | 13,421.24 |
| 9 | Sirohi | 13 | 7,580.00 | 1,072.90 | 14,154.35 |
| 10 | Barmer | 1 | 544.00 | 52.50 | 9,650.74 |
| 11 | Jalore | 1 | 112.00 | 31.74 | 28,339.29 |
| 12 | Bundi | 14 | 5,625.00 | 789.56 | 14,036.62 |
| 13 | Baran | 10 | 5,544.00 | 1,538.00 | 27,741.70 |
| 14 | Jhalawar | 6 | 2,788.00 | 557.62 | 20,000.72 |
| 15 | Banswara | 19 | 4,990.00 | 1,001.07 | 20,061.52 |
| 16 | Dungarpur | 17 | 4,005.00 | 643.38 | 16,064.42 |
| 17 | Bhilwara | 9 | 7,348.00 | 1,267.06 | 17,243.60 |
| 18 | Chittorgarh | 20 | 6,536.00 | 901.93 | 13,799.42 |
| 19 | Rajsamand | 19 | 5,181.00 | 795.10 | 15,346.46 |
| 20 | Udaipur | 4 | 1,378.00 | 228.37 | 16,572.57 |
| 21 | Salumber | 9 | 3,671.00 | 1,065.40 | 29,022.06 |
| | Average | | 4,189.49 | 682.64 | 17,239.54 |

Source: Physical & Financial Progress of Rehabilitation of Sub-project (Rajasthan Minor Irrigation Project)

While reviewing the RWSRP project reports, it was observed that some of these have been analysed in great detail, and cost estimates prepared in a fairly detailed manner while in other cases the estimates are based on lump-sum unit cost basis for entire components such as regulating structures, cross-drainage works, restructuring and remodelling of canals, etc.; such estimating do not appear to be reliable, considering the age the project, the necessary improvements and various other factors. It was therefore decided to select as a basis for evaluating unit cost only those projects where detailed estimates had been prepared. The cost estimate prepared for the various RWSRP

projects are given in price terms varying between years 2000 and 2010. These have been adjusted to bring all the costs to the year 2010 price level, using the escalation factors, as summarised in Table A1.4.

Table A1.4 Summary of Unit Cost estimates for Canal Rehabilitation

| S. No. | Class and Name of Project | Age in Year at end of 2010 | CCA (ha) | Unit Cost (Rs./ha) | | |
|---|---|---|---|---|---|---|
| | | | | As per RWSRP | Year of Estimate | At March 2010 Price |
| (i) | 2,000 to 5,000 ha of CCA | | | | | |
| | Mansarover | 53 | 3,168 | 4,704 | 2000 | 8,258 |
| | Kalakho | 57 | 3,450 | 5,284 | 2000 | 9,273 |
| (ii) | 5,000 to 10,000 ha | | | | | |
| | Juggar bund | 53 | 5,927 | 4,548 | 2000 | 7,982 |
| | Orai | 35 | 9,260 | 7,283 | 2010 | 7,283 |
| (iii) | 10,000 to 50,000 ha | | | | | |
| | Parbati | 47 | 25,368 | 6,580 | 2010 | 6,580 |
| | Galwa | 50 | 13,391 | 7,505 | 2010 | 7,505 |

## 2.2 Applying Unit Cost Derived from RWSRP Studies

### *2.2.1 Cost Escalation*

The cost estimates prepared for the various JICA and RWSRP projects and existing on-going projects reflect price term varying between year 2000 to 2010; these have been converted to a uniform price level of end of financial year 2009-10 i.e. March 2010 by using escalation factor derived from two price index data (published by the GOI and other financial institutions), namely:

India- wholesale price index (WPI) (Base 2005 = 100)

All India consumer price index (CPI) (general) for industrial workers (Base 1982 =100)

The WPI and CPI escalation factors were derived by dividing the WPI and the CPI for year ending March 2010 by the WPI and the CPI of the year for which the factor is to be worked out; then, the escalation factor to be used was calculated by giving 60% weight to WPI and 40% weight to CPI, assuming that the average ratio of material and labour inputs in irrigation project is 60:40. This procedure gives the escalation factors as shown in Table A1.5.

Table A1.5 Project cost Escalation Factors Based on WPI and CPI

| Year | WPI | WPI Escalation Factor | CPI | CPI Escalation Factor | Weighted Escalation Factor |
|---|---|---|---|---|---|
| 1997 | 67.70 | 1.978 | 358 | 2.277 | 2.097 |
| 1998 | 71.75 | 1.866 | 405 | 2.012 | 1.924 |
| 1999 | 74.22 | 1.804 | 424 | 1.922 | 1.851 |
| 2000 | 79.09 | 1.693 | 441 | 1.848 | 1.755 |
| 2001 | 82.90 | 1.615 | 458 | 1.779 | 1.681 |
| 2002 | 84.99 | 1.575 | 477 | 1.709 | 1.629 |
| 2003 | 89.60 | 1.494 | 496 | 1.643 | 1.554 |
| 2004 | 95.49 | 1.402 | 514 | 1.586 | 1.475 |

| Year | WPI | WPI Escalation Factor | CPI | CPI Escalation Factor | Weighted Escalation Factor |
|---|---|---|---|---|---|
| 2005 | 100.00 | 1.339 | 536 | 1.521 | 1.411 |
| 2006 | 104.74 | 1.278 | 569 | 1.432 | 1.340 |
| 2007 | 109.85 | 1.219 | 606 | 1.345 | 1.269 |
| 2008 | 119.39 | 1.121 | 656 | 1.242 | 1.170 |
| 2009 | 122.20 | 1.096 | 727 | 1.121 | 1.106 |
| 2010 | 133.88 | 1.000 | 815 | 1.000 | 1.000 |

### *2.2.2 Extrapolating to All Existing Projects Requiring Rehabilitation and Modernization*

Since the CCA and age of the RWSRP projects vary considerably, a normative approach has been adopted for applying unit costs for rehabilitation and modernization. It was felt that all the projects commissioned prior to the year 1995 generally require rehabilitation and modernization, but that consideration should also be given to the different age of the projects. The unit costs derived from the RWSRP studies were thus increased to reflect the age of the project by year 1995.

For this purpose it was suggested to assume a 1% annual increase in the cost of required rehabilitation and modernization works, relative to the estimates based on the RWSRP and JICA studies for every year prior to 1995 up to year 1935.The annual increase rate was reduced to 0.5% per year beyond 1935. This gives the decadal increased cost factors shown in Table A1.6.

Table A1.6 Rehabilitation Cost Increase Factors

| Decade | Increased Cost Factor |
|---|---|
| 1995-2009 | 1.00 |
| 1985-1994 | 1.10 |
| 1975-1984 | 1.20 |
| 1965-1974 | 1.30 |
| 1955-1964 | 1.40 |
| 1945-1954 | 1.50 |
| 1935-1944 | 1.60 |
| 1925-1934 | 1.65 |
| 1915-1924 | 1.70 |
| 1905-1914 | 1.75 |
| 1895-1904 | 1.80 |
| 1885-1894 | 1.85 |
| 1875-1884 | 1.90 |

The cost of rehabilitation and modernization for canal system of selected RWSRP projects have been converted to the base year 1995 on this basis as given in Table A1.7.

Table A1.7 RWSRP Project Adjusted, 1995 Canal Rehabilitation

| Project | Unit cost Rs./ha | Year of Commissioning | Cost of base year 1995 |
|---|---|---|---|
| 2000 to 5000 ha | | | |
| Mansarover | 8,258 | 1957 | 5,899 |
| Kalakho | 9,273 | 1953 | 6,182 |
| | | Average | 6,040 (Say 6,000) |
| 5000 to 10000 ha | | | |
| Juggar bund | 7,982 | 1957 | 5,701 |
| Orai | 7,283 | 1975 | 6,069 |
| | | Average | 5,885 (Say 5,900) |
| 10000 to 50000 ha | | | |
| Parbati | 6,580 | 1963 | 4,700 |
| Galwa | 7,505 | 1960 | 5,361 |
| | | Average | 5,030 (say 5,000) |

Thus, the normative unit costs applicable to canal systems adjusted by the decadal cost increase factors have been worked out as given in Table A1.8.

Table A1.8 Normative Unit Rehabilitation Cost for Canal System by Decade of Project Age

| Year | Cost (Rs./ha) | | |
|---|---|---|---|
| | 2,000-5,000, ha | 5,000-10,000, ha | Above 10,000, ha |
| 1995-2009 | 6,000 | 5,900 | 5,000 |
| 1985-1994 | 6,600 | 6,490 | 5,500 |
| 1975-1984 | 7,260 | 7,139 | 6,050 |
| 1965-1974 | 7,986 | 7,853 | 6,655 |
| 1955-1964 | 8,785 | 8,638 | 7,321 |
| 1945-1954 | 9,663 | 9,502 | 8,053 |
| 1935-1944 | 10,629 | 10,452 | 8,858 |
| 1925-1934 | 11,161 | 10,975 | 9,301 |
| 1915-1924 | 11,719 | 11,524 | 9,766 |
| 1905-1914 | 12,305 | 12,100 | 10,254 |
| 1895-1904 | 12,920 | 12,705 | 10,767 |
| 1885-1894 | 13,566 | 13,340 | 11,305 |
| 1875-1884 | 14,244 | 14,007 | 11,870 |

Applying these unit costs to the selected RWSRP project produces results as presented in Table A1.9.

Table A1.9 RWSRP Project Cost Estimates (Canal work) Adjusted by the Normative Approach

| Class and Name of Project | CCA, ha | Year of Commissioning | Cost at 2010, Rs./ha | Normative Cost, Rs./ha | Variance |
|---|---|---|---|---|---|
| 2,000 to 5,000 ha | | | | | |
| Mansarover | 3,168 | 1957 | 8,258 | 8,784 | 6.37% |
| Kalakho | 3,400 | 1953 | 9,273 | 9,663 | 4.21% |
| 5,000 to 10,000 ha | | | | | |
| Juggar bund | 5,927 | 1958 | 7,982 | 8,345 | 4.55% |
| Orai | 9,260 | 1975 | 7,283 | 6,897 | -5.30% |
| Above 10,000 ha | | | | | |
| Parbati | 25,368 | 1963 | 6,580 | 7,320 | 11.25% |
| Galwa | 13,391 | 1960 | 7,505 | 7,320 | -2.47% |

It can be seen that the applied unit rates of rehabilitation canal system for projected constructed prior to 1995 the difference between the normative approach costs and the RWSRP cost for selected projects (estimate of which are considered reliable) is within +10%, except Parbati which is slightly higher by about 1% more.

Similar to canal system, existing projects which require rehabilitation and modernization of headworks when extrapolated by age the cost vary considerably compared with RWSRP as demonstrated in Table A1.10.

Table A1.10 Cost of Rehabilitation and Modernization of Headworks Dam (Medium Project Cost)

| Project | Gross Storage $Mm^3$ | Unit cost, $Rs./m^3$ | Year of Commissioning | Base Year 1995 Cost, $Rs./m^3$ |
|---|---|---|---|---|
| Up to 25 $Mm^3$ | | | | |
| Jetpura | 18.54 | 5.95 | 1978 | 4.96 |
| 25 to 50 $Mm^3$ | | | | |
| Orai | 35.28 | 4.24 | 1975 | 3.53 |
| Alnia | 43.71 | 5.63 | 1961 | 4.02 |
| 50 $Mm^3$ and above | | | | 3.78 |
| Moral | 76.62 | 3.26 | 1984 | 2.72 |

Accordingly, the normative cost applied to the said categories has been projected and adjusted by the above-mentioned decadal cost increase factors as given in Table A1.11.

Table A1.11 Adjusted Normative Unit Cost for Rehabilitation of Dam Systems

| Year | up to 20 $Mm^3$ | 20 to 35 $Mm^3$ | 35 $Mm^3$ and Above |
|---|---|---|---|
| | ($Rs./m^3$) | | |
| 1995 - 2009 | 4.95 | 3.78 | 2.72 |
| 1985 - 1994 | 5.45 | 4.16 | 2.99 |
| 1975 - 1984 | 5.99 | 4.57 | 3.29 |
| 1965 - 1974 | 6.59 | 5.03 | 3.62 |
| 1955 - 1964 | 7.25 | 5.53 | 3.98 |
| 1945 - 1954 | 7.97 | 6.09 | 4.38 |
| 1935 - 1944 | 8.77 | 6.69 | 4.82 |
| 1925 - 1934 | 9.21 | 7.02 | 5.06 |

| Year | up to 20 $Mm^3$ | 20 to 35 $Mm^3$ | 35 $Mm^3$ and Above |
|---|---|---|---|
| | ($Rs./m^3$) | | |
| 1915 - 1924 | 9.67 | 7.38 | 5.31 |
| 1905 - 1914 | 10.15 | 7.74 | 5.58 |
| 1895 - 1904 | 10.66 | 8.13 | 5.86 |
| 1885 - 1894 | 11.19 | 8.54 | 6.15 |
| 1875 - 1884 | 11.75 | 8.96 | 6.46 |

Applying these unit costs to selected RWSRP projects produces results as presented in Table A1.12.

Table A1.12 Adjusted Normative Cost Estimate for Selected RWSRP Headwork Projects

| Project | Gross Storage ($Mm^3$) | Year of Commissioning | Cost at 2010 ($Rs./m^3$) | Normative Cost ($Rs./m^3$) | Variance |
|---|---|---|---|---|---|
| Jetpura | 18.54 | 1978 | 5.95 | 5.99 | 0.67% |
| Orai | 35.28 | 1975 | 4.24 | 4.57 | 7.78% |
| Alnia | 43.71 | 1961 | 5.63 | 5.53 | -1.78% |
| Moral | 76.62 | 1984 | 3.26 | 3.29 | 0.92% |

As seen, the variance between the normative approach cost and RWSRP cost for the selected project is within +10%, therefore the given unit cost for rehabilitation of dams prior has been taken as basis of estimate.

The cost of modernization and rehabilitation of minor projects having CCA of less than 2,000 ha (227 projects) as per district-wise estimates prepared under JICA can be adopted which works out to average cost of Rs. 17,240/ha, say, Rs. 17,500/ha at year 2010. This cost can be applied for all the minor projects throughout the State.

## 2.3 Cost of On-Farm Improvements

The above costs do not include land development works necessary to improve on-farm irrigation efficiency. These works include repair and remodelling of watercourses and field channels, and some land levelling.

Where required, field channels and watercourses are maintained by farmers. However, cost of repair and remodelling of water courses have been estimated by the Irrigation Department for the command area of existing projects within the command of the on-going Bisalpur Project. These work out to 830 Rs./ha, including the cost of adjustable proportional module (APM), water distribution structures at a cost of 148.50 Rs./ha, which are included in the estimates presented in the RWSRP studies. Thus the cost of repair and remodelling of water channels alone is (830-148.50=) 681.50 Rs./ha. This is based on 1991 price levels. Allowing for price escalation, the cost at 2010 price level works out at 2,382, say 2500 Rs./ha.

It is very important to have levelled fields for efficient application of water, fertilizers, etc., and to assure a uniform growth of crops in the field. Since in most of the areas, the land holdings are small, the levelling and formation of small plots as necessary for efficient irrigation can be done by farmers with their own animal labour. In some areas, mechanical means may however be necessary for land levelling, for which a general provision of 1,500 Rs./ha is proposed to be made.

Thus, the following unit costs are recommended to be adopted:

Improvement of watercourses and field channels: 2,500 Rs./ha.

Land levelling: 1,500 Rs./ha.

# 3. Cost of Canal System in Additional Command Areas

## 3.1 Unlined Canals

As shown above, the overall cost per ha of a medium irrigation project with unlined canal system (only selective lining in critical sections) averages 178,000 Rs./ha, and the cost per $m^3$ of storage in medium projects is 26 Rs./$m^3$. Taking 5,000 $m^3$ as an average water requirement per ha of CCA, the cost of storage per ha works out as (5,000*26=) Rs. 130,000, and the balance unit cost for an unlined canal system is (178,000-130,000=) 48,000 Rs./ha. To express the variation in the cost per ha of canal systems according to the size of the project, a factor of 0.95 was applied for projects having a CCA of between 7,000 and 10,000 ha, and a factor of 1.05 was applied to projects having a CCA of 2,000 to 4,000 ha.

## 3.2 Lined Canals

The cost of lined canal systems in plain areas may be taken as 64,000 Rs./ha, as shown in the Table A1.17.

Table A1.17 Cost of Lined Canal System

| S. No. | Project | CCA (ha) | Total Cost of Canal System at 2010 Prices (Million Rs.) | Unit Cost (Rs./ha) |
|---|---|---|---|---|
| 1 | Narmada Project | 246,000 | 11,284 | 45,870 |
| 2 | Manohar Thana | 9,834 | 858 | 87,208 |
| 3 | Rajgarh | 6,827 | 403 | 59,011 |
| | Average | | | 64,030 |

The same adjustment factors suggested above (Para. 3.1) for unlined canal systems were also applied in estimating the cost of lined canal systems.

## 3.3 On Farm Development Work

According to Bisalpur Project estimates, the cost per ha of watercourses is Rs. 11,500 at 2009 prices. Adding price escalation, the March 2010 cost works out as 12,700 Rs./ha and as per guidelines issued on command area development and water management programme by CADA/ MOWR GOI the cost per ha. On farm development (which is comprising of construction of water courses/ field channels, Land levelling and Realignment of field boundaries where necessary) has been kept as Rs. 15000/- per ha. Therefore the same (Rs. 15000/- per ha.) cost can be considered representative for the basins in eastern Rajasthan. In western Rajasthan basins, where, because of the prevailing types of soil and the adverse topographical conditions, watercourses are lined and have much larger discharge capacities, as result of which the cost of construction of water courses/ field channels, Land levelling and Realignment of field boundaries where necessary has been kept as Rs.22,000 per guidelines issued on command area development and water management programme by CADA/ MOWR GOI

### 3.4 Total

The total cost of extending an unlined canal system to additional command area of an existing irrigation project, and of constructing new projects, subject to the adjustment factors described above, amount to values as given in Table A1.18 and A1.19 for unlined and lined canals, respectively.

Table A1.18 Total Estimated Cost of Extending Unlined Canal System

| Component | Unit Cost (Rs./ha) |
|---|---|
| Canals | 48,000 |
| On Farm Development works | 15000 |
| **Total** | **63000** |

Table A1.19 Total Estimated Cost of Extending Lined Canal System

| Component | Unit Cost (Rs./ha) |
|---|---|
| Canals | 64,000 |
| On Farm Development works | 22000 |
| **Total** | **86000** |

## 4. Wells

### 4.1 Dug Wells

The unit of dug wells was calculated on the basis of 2010 BSR of special schemes organization (GOR), according to which the average cost of dug wells per m depth is Rs. 3570 in alluvium of 2.5 m diameter well and Rs. 4250 in hard rock having 3.5 m diameter well.

### 4.2 Drilled Wells

The unit cost of drilled wells is based on a letter issued on 10/10/2005 by Ex. Engineer, Rajasthan Ground Water Department, and Circular No. SEDM/I (1) 95-96/159, dated 1.3.96 by the Public Health Engineering Department (PHED), GoR giving the following rates, in Rs./m:

| Item | Unit | Drilling cost in Rs./m for various diameters (Dia.) | | | | |
|---|---|---|---|---|---|---|
| | | In Hard Rock | | | In Alluvium | |
| | | 110-115 mm Dia. | 150 mm Dia. | 175-200 mm Dia. | 200-250 mm Dia., Rotary Rig | 250-300 mm Dia., Percussion Rig |
| Drilling | Rs./m | 270 | 449 | 627 | 1238 | 2115 |
| Assembly / Casing* | Rs./m | 274 | 728 | 980 | 1112 | - |
| Additional Charge & DCB | Rs./m | 500 | 700 | - | - | - |

* In hard rock casing has been considered for 10m.

These costs do not include well development & assembly lowery including gravel pack, which has been taken as Rs. 495/m.

For planning purpose it was assumed that the depth of well would be 80% of the average depth to basement in the project command area. The drawdown has been considered as 40 m in hard rock and 25 m in alluvial aquifer below the observed pre-monsoon 2010 water table.

### 4.3 Pumping Equipment

The capital cost of pumping equipment for wells was calculated at a rate of 9000 Rs /hp on the basis of prevailing market rates.

## 5. Operation and Maintenance

Annual O&M costs related to irrigation projects were computed on the basis of the following rates, related to capital costs or to unit area, as follows:

| | |
|---|---|
| Headworks - | 1% |
| Pumps - | 5% |
| Standby pumps - | 2.5% |
| Pipeline - | 3% |
| Canal systems - | Rs. 564.00 per ha |
| Water course - | Rs. 312 per ha |

Sources of information used for these figures are as follows:

- Maintenance of canal systems – As per estimate of Narmada canal Rs. 1387 lac has been taken as project maintenance for 2.46 lac ha area. The O&M charges of canal system works out as 563.8 per ha.
- Maintenance of water courses – as taken in Bisalpur project (2009), at 1% of the capital cost, or Rs. 28261 per ha, which, in price terms of March 2010 amounts to 28261 x 1.106 x 0.01 Rs. say 312.

## 6. Groundwater Pumping Costs

### 6.1 Energy

Electrical energy required for pumping, in kWh $= \frac{W \times Q \times h \times 0.746}{75 \times \eta \times 3600}$ where

Q = Volume of Water in $m^3$

h = head, in m

W = weight of water (1000 kg/$m^3$)

$\eta$ = product pump and motor efficiency, taken as 75% and 90%, respectively.

With these assumptions the electrical energy required works out to $\frac{Qh}{244.3}$, say $\frac{Qh}{250}$.

### 6.2 O&M

The O&M cost of pumping by wells has been worked out to cover its operation and maintenance and the electricity costs.

Maintenance costs were taken as 5% of the capital cost of the pumping equipment and accessories. Electricity costs has been taken as Rs. 2.31 per kWh (which includes Rs. 0.04 per kWh as tax and Rs. 0.02 per kWh as permanent fee), which is the unsubsidized rate of electricity for agriculture, at March 2010 price level, based on Rajasthan State Electricity Board Rates.

Hence, the cost of pumping a unit volume of water ($m^3$) is Rs. $\frac{2.31 \times 1 \times h}{250}$ **i. e. Rs.** $\frac{h}{108}$.

## 6.3 Present Groundwater Scenario

The present (2010) groundwater scenario in the project command area of 35 Irrigation projects identified for detailed study is given below.

| S. No. | Project | Stage of Groundwater Development in Project Command Area | Pre-monsoon 2010 depth to water table, m bgl | Head of pumping, m |
|---|---|---|---|---|
| 1 | Arwar | 245.56% | 11.67 | 51.67 |
| 2 | Badgaon | 217.85% | 21.82 | 61.82 |
| 3 | Bagolia | 207.53% | 19.19 | 59.19 |
| 4 | Bassi | 112.08% | 11.02 | 51.02 |
| 5 | Bhupalsagar | 75.15% | 13.78 | 53.78 |
| 6 | Bilas | 138.33% | 13.37 | 53.37 |
| 7 | Chandra Bhaga | 207.15% | 16.12 | 56.12 |
| 8 | Chandsen Bheru Sagar | 59.66% | 14.41 | 54.41 |
| 9 | Chaparwara | 97.13% | 12.83 | 52.83 |
| 10 | Dheel | 153.13% | 18.25 | 58.25 |
| 11 | Dindoli | 172.94% | 26.13 | 66.13 |
| 12 | Dugari | 59.89% | 17.14 | 57.14 |
| 13 | Galwania | 78.55% | 17.25 | 57.25 |
| 14 | Gopalpura | 55.07% | 10.82 | 50.82 |
| 15 | Jaisamand | 83.45% | 9.08 | 49.08 |
| 16 | Jakham | 81.39% | 7.22 | 47.22 |
| 17 | Kalisil | 167.43% | 21.31 | 61.31 |
| 18 | Khari | 263.44% | 22.44 | 62.44 |
| 19 | Kothari Dam | 148.54% | 15.05 | 55.05 |
| 20 | Lassariya | 234.43% | 11.25 | 51.25 |
| 21 | Madho Sagar | 138.20% | 41.73 | 81.73 |
| 22 | Mahi Bajaj Sagar | 36.22% | 6.60 | 46.60 |
| 23 | Mataji Ka Khera | 109.41% | 18.30 | 58.30 |
| 24 | Meja | 254.38% | 15.61 | 55.61 |
| 25 | Murlia | 225.47% | 10.35 | 50.35 |
| 26 | Narayan Sagar | 245.63% | 17.47 | 57.47 |
| 27 | Rajsamand | 152.88% | 19.14 | 59.14 |
| 28 | Sardar Samand | 19.87% | 9.30 | 49.30 |
| 29 | Sareri | 122.82% | 16.03 | 56.03 |
| 30 | Som Kagdar | 35.44% | 8.27 | 48.27 |
| 31 | Tordi Sagar | 83.11% | 15.85 | 55.85 |
| 32 | Udai Sagar | 141.65% | 14.05 | 54.05 |
| 33 | Ummed Sagar (Bhilwara) | 147.29% | 8.97 | 48.97 |
| 34 | Vallabhnagar | 184.78% | 13.84 | 53.84 |
| 35 | Wagon Project | 178.72% | 17.45 | 57.45 |

# 7. Sprinkler System

## 7.1 Unit Cost of Sprinkler System for 100 ha

In most of the irrigation projects command area is under gravity flow and irrigation is being applied to crops through surface method which is older and most common. In this system the water is directly applied to the soil surface from channel or an open ditch at top end of the land. In the system significant losses occur due to percolation and soil evaporation which leads to very low irrigation application efficiency. Therefore, it is proposed that in place of surface (flooding) method Sprinkler system should be introduced to increase irrigation application efficiency. The Unit cost of Sprinkler system for 100 ha was estimated in Narmada project which includes cost of diggie, pump room, sump wells, HDPE pipe network, pumps, motors, nozzles etc. and cost of system was estimated as Rs. 69,960 /ha as per 2009 price level. After adding escalation, the cost at 2010 price level work out as Rs. 77,376 say Rs. 77,500 /ha.

**Abstract of cost for 100 ha plot**

| S. No. | Items | Amount in Rs. (2009 price level) |
|---|---|---|
| 1 | Diggies | 615,154 |
| 2 | Pump Rooms & Boundary wall | 614,240 |
| 3 | Sump Wells | 128,155 |
| 4 | HDPE Pipe Network | 1,083,000 |
| 5 | Pumps and Motors | 424,300 |
| 6 | Cost of Pipeline | 2,700,000 |
| 7 | Cost of Nozzles | 800,000 |
| | **Total** | **6,364,849** |
| | Rate for 100 ha | 6,364,849 |
| | Rate per ha | 63,648 |
| | Add 10% for electricity transmission and connection | 6,365 |
| | Total Rate per ha, Rs. | 70,013 |
| | Add escalation for 2010 @ 10.6% | 7,421 |
| | Total Rs. | 77,434 |
| | **Say Rs.** | **77,500 per ha** |

**Abstract of cost for 100 ha plot if the source is existing well using groundwater:**

| S. No. | Items | Amount in Rs. (2009 price level) |
|---|---|---|
| 1 | HDPE Pipe Network | 1,083,000 |
| 2 | Cost of Pipeline | 2,700,000 |
| 3 | Cost of Nozzles | 800,000 |
| | **Total** | **4,583,000** |
| | Rate for 100 ha | 4,583,000 |
| | Rate per ha | 45,830 |
| | Add escalation for 2010 @ 10.6% | 4,858 |
| | Total Rs. | 50,688 |
| | **Say Rs.** | **51,000 per ha** |

## 7.2 Energy Requirement

Energy requirement @ 25 kW per diggi has been considered in Narmada project accordingly, for 100 ha the energy requirement is 25 kW.

# Annex 2

# Irrigation Projects Planning and Economic Analysis

# Annex 2

# Irrigation Projects Planning and Economic Analysis

## 1. Introduction

This Annex describes the methodology developed by Consultants for appraising irrigation project improvement plans, for the purpose of their economic analysis and prioritisation. It further elaborates on the assumptions and the computational procedures involved in project appraisal, with the help of a sample project appraisal.

The methodology of computing irrigation benefits is fully elaborated in Annex 3. For this purpose a special computational tool, called Crop Mix Linear Programming (CMLP) was developed by the Consultants, and is presented in Annex 3.

The main characteristics and cost estimate of each plan were entered into the Project's data base and this information served as the basis for: a) carrying out the economic analysis and prioritisation of identified projects for rehabilitation (see Annex 3).

Further details, supporting documents, calculation sheets, etc. of the appraisal of individual Major and Medium irrigation projects, including a project planning worksheet are kept in project files, which will be handed over separately to the Water Resources Department.

## 2. Irrigation Projects Status

There are 112 major and medium irrigation projects (including canal projects having imported surface water). Out of the 112 Projects, 43 major and medium projects are under rehabilitation under RWSRP and performances of some of the projects show that these projects do not require further rehabilitation. For the projects which were commissioned recently, it has been observed that there is no requirement for rehabilitation and modernization due to area is not fully developed or open for irrigation. Therefore, the remaining project for which water is stored in reservoir at regular interval and is being used for irrigation are considered as projects for rehabilitation.

## 3. Assessment of Surface Water Potential

Surface water availability for the identified projects has been taken from Final Report No. 4.3 (of this study) on Detailed Study on Catchment Areas, which has been calculated using SWAT Model at 25%, 50%, 75% and 90% climatic dependability levels.

## 4. Appraisal of Identified Existing Projects

### 4.1 Introduction

The appraisal of existing irrigation projects consisted of: (i) projecting the availability of water; (ii) assessing the need to modify, expand or improve water storage and distribution facilities; and (iii) estimating the capital and O&M costs of project improvement and modification works, as and where necessary.

These factors were evaluated for two alternative scenarios: with the proposed rehabilitation works (called the "with-plan" scenario) and without the proposed rehabilitation works (called the "without-plan" scenario). The without-plan scenario was defined as the least-cost alternative course of action to be taken if the with-plan works are not implemented.

These factors were also evaluated for stages - present (2010) and years 2020, 2040 and 2060, and for four climatic state dependabilities - 90%, 75%, 50% and 25%.

As an aid to the calculation of the various results of the project appraisal, a spreadsheet called Project Planning Worksheet was developed (see section 5 below). This Worksheet also served for analysing the economic viability of improvements and modifications in existing irrigation projects, applying the benefits computed by the CMLP model, and it also gave values of economic and other indicators which are required for the priority ranking of projects (see 5 below).

The following paragraphs describe the project appraisal procedures and the methodology of assessing the availability of water in individual irrigation projects and estimating the costs involved in the proposed improvement and modification works. Section 5 gives a detailed, step-by-step description of the input data and results of project appraising, following the structure of the Project Planning Worksheet.

## 4.2 Storage Reservoirs

### *4.2.1 Adequacy of Storage*

**a) General**

The storage capacity of every existing Major and Medium irrigation project was compared with the catchment yield, and recommendations to increase it were made where this was found feasible, in order to make better utilisation of the available water.

The storage capacity considered for this analysis takes into account siltation which may have taken place in the reservoir since the dam was completed, as well as expected future accumulation of silt, up to the end of the planning period, i.e. year 2060.

If the computed effective storage capacity of an existing reservoir in the year 2060 was found to be smaller than the annual catchment yield at 75% dependability, the technical and economic feasibility of increasing the storage capacity was examined in very preliminary terms, keeping in view the extent of cultivable area which can be commanded by the reservoir.

In case the storage capacity is larger than the annual catchment yield, the possibility of diverting water into the reservoir from areas of water surplus was examined.

The amounts of water available from the reservoir for irrigation and other uses, were computed for all the Planning Stages and for the four specified levels of dependability of the climatic state, as well as the weighted mean (see project appraisal of Arwar project in Annex 4).

**b) Dam Siltation and Reservoir Losses**

Siltation rates have been estimated on the basis of data from studies of existing reservoirs in the same river basin, as well as information on silt load observations at river flow gauging sites maintained by the Central Water Commission (CWC) and ID.

In case no reliable data are available from these sources, siltation rates were adopted on the basis of estimated siltation rates in other basins.

A conservative assumption was made for the purpose of the present study, that 55% of the incoming silt is deposited in the live storage and 45% in the dead storage (for details see project appraisal of Arwar Project in Annex 4).

The following table presents the silt load values adopted by the Consultants for the different River Basins and the basis of its adoption.

| River Basin | Siltation, $m^3/km^2/yr$ | Basis of Adoption |
|---|---|---|
| Shekhawati | 255 | Same as in Luni basin plain part |
| Ruparail | 153 | Average of Banganga and Gambhir basin |
| Banganga | 131 | Same as in Banas basin |
| Gambhir | 175 | Average of Chambal and Banas basin |
| Parbati | 175 | Average of Chambal and Banas basin |
| Sabi | 142 | Sodawas stream gauging site |
| Banas | 131 | Assessment through satellite Remote sensing at Bisalpur dam |
| Chambal | 218 | Average of Khatoli and Aklera gauge sites |
| Luni Mountainous part | 194 | Assessment through satellite Remote sensing at Jawai dam |
| Luni Plain part | 255 | Jaswant sagar project study |
| Sukli | 255 | Same as in Luni basin |
| West Banas | 131 | Same as in Banas basin |
| Mahi | 350 | Mataji gauging site data |
| Sabarmati | 240 | Average of Mahi and Banas basin |

The calculation of the net availability of water in any reservoir allows for losses such as evaporation, seepage etc. These have been based on a review of 29 actual reservoir operation data from a number of projects in various ACZ. This review has indicated that the range of reservoir loss values is not very wide, and is mainly related to the evaporation, while seepage losses are generally relatively low due to the impermeability of the reservoir bottom area, caused by its siltation, except in specific cases where the geological formation may cause excessive seepage. Evaporation in some of the projects after Rabi season is not much as these projects are designed for Rabi season only and most of the water is supplied till the end of Rabi season and the reservoirs are almost empty after Rabi season, hence the water spread area of reservoir reduces resulting in less losses in summer season. Reservoir losses estimated for 29 projects are given below. ACZ-wise where project exists, the following values were obtained.

| S. No. | ACZ | Name of Project | % of Evaporation Annual | % of Evaporation (Rabi Session) |
|---|---|---|---|---|
| 1 | IIb | Jawai | 10.48 | 5.00 |
| **Average** | | | **10.48** | **5.00** |
| 2 | IIIa | Chhaparwara | 19.11 | 8.65 |
| 3 | IIIa | Galwa | 26.92 | 11.16 |

| S. No. | ACZ | Name of Project | % of Evaporation Annual | % of Evaporation (Rabi Session) |
|---|---|---|---|---|
| 4 | IIIa | Mashi | 28.43 | 12.98 |
| **Average** | | | **24.82** | **10.93** |
| 5 | IIIb | Kali Sill | 9.73 | 4.68 |
| 6 | IIIb | Parwati | 13.69 | 6.37 |
| **Average** | | | **11.71** | **5.52** |
| 7 | IVa | Rajsamand | 12.78 | 6.14 |
| 8 | IVa | Meja | 14.87 | 7.15 |
| 9 | IVa | Jaisamand | 13.10 | 6.30 |
| 10 | IVa | Mataji Ka Khera | 19.32 | 9.29 |
| 11 | IVa | Wagan | 21.16 | 10.17 |
| 12 | IVa | Udai Sagar | 14.29 | 6.87 |
| 13 | IVa | Bassi | 18.93 | 9.10 |
| 14 | IVa | Murlia | 14.93 | 7.18 |
| 15 | IVa | Jakham | 5.20 | 2.46 |
| 16 | IVa | Orai | 15.02 | 7.11 |
| 17 | IVa | West Banas | 16.50 | 8.79 |
| 18 | IVa | Nand Samand | 14.16 | 8.72 |
| 19 | IVa | Somkagadar | 9.86 | 4.92 |
| 20 | IVa | Bhimlat | 15.35 | 6.95 |
| 21 | IVa | Abhaypura | 17.20 | 7.80 |
| **Average** | | | **14.85** | **7.26** |
| 22 | IVb | Mahi | 7.46 | 3.40 |
| 23 | IVb | Som Kamla Amba | 15.53 | 7.95 |
| **Average** | | | **11.49** | **5.67** |
| 24 | V | Chhapi | 11.77 | 5.18 |
| 25 | V | Ummed Sagar | 17.74 | 8.58 |
| 26 | V | Surwal | 28.03 | 12.17 |
| 27 | V | Burdha | 10.77 | 4.76 |
| 28 | V | Gudha | 14.88 | 6.91 |
| 29 | V | Mansarowar | 14.04 | 6.92 |
| **Average** | | | **16.21** | **7.42** |

### *4.2.2 Increasing Reservoir Capacity*

While considering the possibility of increasing the storage capacity of existing Major and Medium dams by raising the full reservoir level (FRL), the most important aspect is to avoid additional submergence of fertile land and inhabited areas on a large scale. There is strong resistance to submergence of land and populated areas all over the country, and proposals involving these may not be feasible.

This problem can be reduced to a large extent if the FRL is not raised above the planned maximum water level (MWL), if these are not the same. This would incur submergence of land between FRL and MWL for slightly longer periods than at present in rainy years, for which, according to the GOR policy, only compensation for lost crops is to be paid to affected land owners.

Additional storage can be created by raising the FRL to the MWL while increasing the capacity of the dam's spilling facilities to compensate for the loss of floodwater storage capacity. In such cases the technical possibility of increasing the spilling capacity and safety of the dam, and the necessary changes in appurtenant structures, were examined in general terms by the Consultants, but further detailed investigations would indeed be required before finalising such a change in any dam.

In the appraisal of existing projects, the recommended storage capacity was established by running the Planning Worksheet in tandem with the CMLP model for alternative values of storage capacity and comparing the costs and benefits.

## 4.3 Irrigation Systems

### *4.3.1 General*

The actual amounts of water released to the project's main canal during the last few years, according to ID records, were compared with the water actually applied to the crops actually grown, and this gave a general estimate of the overall irrigation efficiency in the project. On this basis, general recommendations were made for improving and modernising existing systems, and the required investments were estimated on the basis of costs per hectare (see Annex 1).

### *4.3.2 Evaluating Irrigation Efficiency in Existing Projects*

The actual overall irrigation efficiency in the existing projects selected for detailed appraisal, was evaluated by comparing the amounts of water actually supplied to the crops, estimated on the basis of crops grown and corps water requirement, with the amounts of water released to the canal system.

### *4.3.3 Irrigation Efficiency and Loss Values Assumed for the With-Project Scenario*

For the purpose of analyzing the economic feasibility of introducing improvement in existing irrigation system the consultant have reviewed the results of already rehabilitated project under RWSRP and conservatively assumed that the following efficiencies can be attained.

1. Off-farm conveyance efficiencies in existing projects after improvement are 72% for selective lining and 75% for complete lining.
2. On-farm efficiency is 70%. The percolation losses and evaporation losses are 25% and 5% respectively.

### *4.3.4 Extent of CCA*

In general, the cost estimates of rehabilitation and modernisation works in existing projects were computed for the entire developed CCA. This - in spite of the fact that in several cases, where the extent of the CCA was found by the Consultants to be disproportionately high in comparison with the availability of water, the irrigation benefits are computed, with the aid of the CMLP model for a smaller number of hectares, which the model finds as economically feasible to irrigate with the available water.

This approach was followed in view of the practical as well as procedural difficulties which may be encountered if in fact rehabilitation and modernisation works were to be

implemented on just part of the existing irrigation system, and even more so if water were to be delivered to only that part of the CCA.

## 4.4 Groundwater Utilisation

### *4.4.1 Introduction*

The analysis of Major and Medium irrigation projects, includes the computation of groundwater availability within the command area, taking into account the natural aquifer replenishment as well as irrigation and domestic water supply return flows (urban waste water is treated separately), and allowing for the supply of groundwater to domestic consumers, livestock etc. within the command area.

A distinction is made in the Project Planning Worksheet between areas where there is no sizeable aquifer storage, and others, where the aquifer has a long-term storage regulation capacity, as explained below.

The costs incurred by incorporating additional groundwater in the supply of water for irrigation, by introducing mechanised wells, were taken into account on the basis of data about number of wells (collected from tehsil, village wise) and yield of wells, and well construction costs, obtained from RGWD.

### *4.4.2 Natural Replenishment*

The availability of groundwater was based on the analysis and adopting GEC methodology (1997). This methodology has been described in detail in Final Report No. 4.4 on Groundwater Study by Agroclimatic Zones wherein the groundwater assessment has been done village wise.

### *4.4.3 Return Flows*

Considering the generally low aquifer transmissivities in Rajasthan it was assumed that irrigation return flows are utilisable only within the gross command area of the project.

Return flows were computed as follows, and added to the natural replenishment (see paragraphs 4.3.2 and 4.3.3 above for a discussion of irrigation efficiencies and losses).

- Distribution and on-farm losses in surface water irrigation systems:

| | Percent of water supplied from the dam | Percent of water reaching the plot |
|---|---|---|
| In existing systems under present conditions: | Combined: 70% of water supplied from the dam × (1-combined irrigation efficiency/100) | |
| In existing systems after improvement: | 18 | 25 |
| In groundwater-irrigated areas: | 0 | 20 |

- Losses from urban domestic water supply systems - 30% of the gross supply, decreasing with time

- Losses from rural domestic water supply systems - 10% of the gross amount supplied.

### *4.4.4 Total Groundwater Availability and Potential Utilisation*

Total groundwater utilisation in individual Major and Medium irrigation projects, including return flows, was computed differently for two possible aquifer storage situations - with and without long-term storage regulation capacity.

Where long-term aquifer regulative capacity was assumed not to exist, the total groundwater availability varies according to the amount of surface water available at each of the four dependability levels. The total amount of groundwater available at each dependability level is the sum of the mean annual (or Normalised) natural replenishment, artificial recharge (if any), and return flows. Return flows include an assumed percentage of the surface water supplied to the CCA, and this amount varies in direct proportion to the surface water. But the total amount of groundwater and return flows available at each dependability level is also constrained by the annual pumping capacity of wells, which is computed as explained in section 4.4.5 below.

Where long-term aquifer storage regulation capacity was assumed to exist, i.e. where a deep alluvial aquifer exists beneath a project's CCA, the following procedure was employed in the Project Planning Worksheet, in order to use more groundwater in years of low surface water availability, and less in years of higher surface water availability:

- At the 90% and 75% surface water dependability levels, the utilisable regulated groundwater equals the weighted mean of the total surface water and groundwater available for irrigation (according to the calculation without aquifer regulation), less the surface water available at these dependabilities, and limited to the annual groundwater pumping capacity (see below).
- At 50% dependability the utilisable regulated groundwater is taken as the maximum of these two: 1) weighted mean of total surface and groundwater available for irrigation (according to the calculation without aquifer regulation) less the surface water available at this dependability; 2) weighted mean of unregulated groundwater available (according to the calculation without aquifer regulation).
- At 25% dependability the regulated groundwater utilisation is calculated by using the regulated utilisation values obtained for 90%, 75% and 50% dependabilities, and their respective weights, so that the weighted mean groundwater utilisation for all the dependabilities remains the same.

This procedure is included in the Project Planning Worksheet, which also calculates the weighted average annual availability of groundwater. However, subsequently, the computation of irrigation benefits by the CMLP model (see Annex 3) allows groundwater to be utilised in any of the Climatic States up to the annual maximum pumping capacity, which is computed as explained in the following paragraph, while maintaining the weighted mean annual utilisation same as computed by the Worksheet.

#### *4.4.5 Number of Wells*

The number of existing wells within a project's command area are taken based on village wise information for year 2010. For the villages falling partially within the command area number of wells were estimated on area proportion basis.

The number of additional wells required to utilise the groundwater potential within a project's command area - after deducting domestic, livestock and industrial water supply requirements from groundwater within the CCA - is computed by increasing by a factor of 1.3 the weighted mean groundwater potential available for irrigation (including return flows) and dividing this by the average well yield in the relevant village. The average annual well yield is computed using average daily well yield figures obtained from the RGWD, and considering 150 pumping days in a year. These additional wells are then costed and added to the other planned investments in existing irrigation projects.

The total groundwater pumping capacity of the existing and additional wells thus computed, serves as the upper bound on the utilisable annual amount of groundwater in both types of aquifer storage regulation described above.

### 4.5 Non-Agricultural Water Demands

Urban domestic and industrial water requirements from irrigation projects were taken into account according to the known links or supply commitments. Rural domestic water requirements and livestock requirements were computed for the gross command area (GCA) of the project on a proportional area basis, relative to the relevant Block area. These figures were deducted from the availability of surface and groundwater, to give the net amounts available for irrigation (see more details in the description of the Planning Worksheet in section 5).

### 4.6 Cost Estimates

The cost of improvements in calculated within the project sheet based on the unit cost basis developed by the Consultants for the purpose of estimating the investments and operational costs of the improvement plans as given in Annex 1.

## 5. The Project Planning Worksheet

### 5.1 Introduction

To facilitate the performance of various computations in the process of appraising projects and formulating a plan for improvements, a project planning worksheet has been devised as an Excel electronic spreadsheet. A sample Worksheet is presented in Annex 4 for Arwar Project of Banas River Basin.

This computational aid was also designed to be linked with the Crop Mix Linear Programming (CMLP) model described in Annex 3, as explained in section 5.5 below.

All the input data, and the results related to the economic analysis performed with these data, must be given for two scenarios - with and without the plan being considered with respect to improvement and modifications in the existing projects.

All the time-related input data and results are in annual terms, unless otherwise indicated, specified for four Planning Stages: present (2010), year 2020, year 2040 and year 2060.

## 5.2 Input Data

Input data to the Worksheet include the following

a) Identifying details of the project, such as name, status, River Basin, groundwater potential zone, etc., and the present (2010) estimated live and dead storage of the reservoir (allowing for silt accumulation since dam completion year); free catchment area, linked projects (if any); and also an indication of the aquifer category.

b) Priority annual water demand figures for the four Planning Stages, from surface and ground water; should be equal with and without the proposed plan, except in the case of rural domestic , livestock and other demand, because these demands are computed on the basis of rates per hectare, also in this category should be included any amount of surface water committed to be exported from the current project to another project;

c) The project's CCA; actually irrigated area and quantity of water utilized in Particular year - for information only;

d) Surface water catchment yields - mean and at four dependabilities, for the four Planning Stages (to enable entering a change in catchment yield if at any time in the future a new dam upstream is contemplated) - must be equal with and without plan;

e) Reservoir loss factors per year and during Rabi season only;

f) Reservoir siltation load per km2 of catchment area per year, and percentage silt deposition in the dead storage part of the dam;

g) Present and planned import of water to the project's reservoir, mean and four dependabilities, for the four Planning Stages;

h) Irrigation efficiency factors;

i) Peak monthly supply capacity, as percentage of annual surface water available - can be changed from one Planning Stage to the next;

j) For lift schemes: maximum pumping capacity, head (including losses), number of hours of operation per year and length of discharge main;

k) Groundwater natural replenishment figures which may increase if at any stage in future.

l) Aquifer mining potential, if this is considered as an additional temporary source of groundwater;

m) Artificial recharge - amounts of water planned to be recharged, mean and at four dependabilities, in the four Planning Stages;

n) Return flow factors for areas irrigated by surface water, with and without plan;

o) Return flow factors for areas irrigated by wells, with and without plan;

p) Return flow factors for domestic water consumers;

q) Average annual yield of a well in the command area;

r) Number of irrigation wells existing within the gross command area (GCA), possibly increasing or decreasing with time if the GCA is planned to be expanded or reduced;

s) Peak monthly supply capacity from wells within the GCA (existing and additional required), as a percentage of their annual supply capacity;

t) Reclaimable sewage, in percent of net domestic water consumption in towns and cities within or close to the project GCA;

u) Investments, in March 2010 price terms:
- Cost of new civil works, in million Rupees;
- Investment in rehabilitation or modification of existing civil works (except the project's irrigation system, Rs. Million, to be specified per Planning Stage, with plan;
- Unit cost of a pumping equipment, in thousand Rupees per m3/sec per metre head;
- Unit cost of discharge main, in thousand Rupees per m3/sec per km length;
- Unit cost of improving irrigation systems (i.e. main canals, distributaries and water courses): per hectare of CCA being rehabilitated and modernized, and per hectare of newly created CCA, in Rupees;
- Unit cost of a typical well in the project's command area;
- Unit cost of a well pump;
- Cost of pumps on canals, in Rs. Million if pumping directly from a canal is proposed, for irrigating an additional area;
- Unit cost of a drainage system, if required in the project's command area, Rs. Million/ha;
- Depreciation periods of different main categories of facilities and their construction duration, in years;

v) Annual operation and maintenance (O&M) costs:
- Percentage of total investment in new civil works;
- Cost per hectare of newly created CCA;
- Annual energy costs, based on the weighted mean total pumping, in Rs./m3, separately for pumping by wells, pumping in lift schemes, and pumping from canals;
- Annual O&M cost, as percent of investment in pumps;
- Any additional O&M costs with plan, including the O&M of standby pumping equipment.

w) Earliest possible and latest planned completion year;

x) Weight values assigned to the four levels of climatic state dependability;

y) Percentage increase over the weighted mean available water, for estimating the additional number of wells required.

## 5.3 Results

The following is a brief description of the calculations performed within the project planning worksheet. The sample project appraisal presented in Annex 4 further explain the process of preparing the input data to the worksheet, as well as the results of the calculations and their implications.

**a) Siltation**

Silt accumulation from the dam catchment area is computed according to the free catchment area and silt load per $km^2$ per year, which is then divided between the dead and the live storage parts of the reservoir, at the indicated proportion.

**b) Effective Live Storage**

The effective live storage reduces over time with the accumulation of silt, at a rate being a given percentage of the total silt yield of the catchment (see point f of the input data). In the case of a lift scheme, the annual amount of pumped water is given here (plus reservoir capacity, which is not normally planned in lift irrigation schemes).

**c) Total Surface Water (SW) for Irrigation**

At any Planning Stage and dependability level, the total amount of surface water available for irrigation, with and without plan, is the smaller of two values: 1) effective live storage and 2) catchment yield, plus imports, minus exports (assuming that these take place only during the Monsoon period), from which are deducted: (i) total amount of surface water supplied to domestic, industrial and other priority consumers (see below), plus annual evaporation and seepage losses on this amount; (ii) storage losses during the irrigation (Rabi) season.

**d) Gross SW On Farm**

(i) With plan: total SW available for irrigation, multiplied by the off-farm efficiency factor, which is assumed to be attained under improved conditions in future; (ii) present and without plan: total SW available for irrigation, multiplied by the estimated value of off-farm efficiency at present. The weighted average is worked out by multiplying each value by the weight of the respective dependability of that climatic state. The weighted mean is similarly calculated in all the sections of the worksheet where variation between the climatic states is involved.

**e) Gross On Farm Irrigation Depth**

This is equal to the gross amount of surface water available on farm (point d above) divided by the CCA, and is given in order to indicate the effectiveness of the project without conjunctive use with groundwater.

**f) Peak Month Supply Capacity**

This is a product of the assumed peak month supply capacity in percents, and the amount of water available for irrigation at 25% dependability. This value is only required for the economic analysis in case it becomes a constraint on the supply of water.

**g) Surplus Catchment Yield**

Equals catchment yield and imported water, minus committed export and effective live storage.

**h) Possible Domestic and Livestock Water Supply (WS) from Surface Water (SW)**

This gives the minimum of: 1) surface water demand by cities, towns, villages and livestock within the project's gross command area (GCA), or close-by to it; 2) surface water availability (either yield + imports - committed export, or the effective live storage, after allowing for reservoir losses - the smaller of the two).

**i) Possible Industrial WS from SW**

Industrial WS related to SW can be met as long as it does not exceed the availability of SW (less losses) minus the amount supplied to domestic consumers of surface water. Otherwise, it is equal to SW availability less possible supply to domestic consumers and reservoir losses (point h above).

**j) Possible Other Supplies from SW**

Similarly, other demands for surface water are only met to the extent that surface water is available, after deducting the amounts supplied to domestic and industrial consumers and the reservoir losses.

**k) Return Flows from Areas Irrigated by Surface Water**

Using the return flow percentage values entered for future conditions (i.e. with plan) as well as for present conditions, the return flows to groundwater are computed by multiplying these values by the amounts of SW available for irrigation (point c above). The value related to off-farm return flows is multiplied by the off-farm conveyance efficiency factor, and the product is added to the on-farm return flows coefficient applied to the water available on farm, and the sum of the two return flows, off-farm and on-farm, gives the total return flow from areas irrigated by surface water.

**l) Return Flows from Areas Irrigated by Groundwater**

Without plan in the first Planning Stage (2010), the respective return flow percentage is applied to either the natural replenishment plus mining potential and artificial recharge, if any, minus all the non-agricultural demands from groundwater, or the annual pumping capacity of existing wells in the GCA, whichever is smaller. In the later stages, with plan, the respective return flow percentage is applied to the sum of natural replenishment, groundwater mining potential and planned artificial recharge minus total non-agricultural groundwater demand; without plan - same calculation but with the other return flow factor, applicable to present condition.

**m) Total Irrigation Return Flows**

Equals the sum of return flows from surface water as well as groundwater irrigated areas (points k and l above).

**n) Return Flows from Domestic Water Supply**

Gives the return flows from domestic water supply to cities, towns and villages, at the percentages entered at the various Planning Stages (see point p of input data). These are system losses only, not including waste water.

**o) Total return Flows**

Sum of irrigation and domestic return flows.

**p) Total Available Groundwater (GW) for Irrigation**

The total volume of groundwater available for irrigation includes the natural replenishment plus total return flows, artificial recharge and mining potential, less total non-agricultural demand from groundwater. To arrive at values of groundwater available for irrigation at different dependabilities, return flows at different dependability from surface water irrigation and groundwater irrigation as per the given percentages (which varies in each dependability, less in 90% dependability and more in 25% dependability) have been added to the rainfall recharge in the command area of the project.

**q) Total Utilizable Groundwater for Irrigation**

This gives the total annual amount of groundwater available for irrigation, limited to the maximum annual groundwater pumping capacity. These amounts indicate the upper utilization limits, while the actual use is subsequently determined by the CMLP model.

**r) On-Farm GW Irrigation Depth**

Equals total utilizable GW for irrigation (point q above) divided by CCA, and indicates the water depth if only GW is used.

**s) Number of Additional Wells**

The number of wells required to pump the total amount of groundwater available for irrigation (point q above) is computed by increasing by a predetermined percentage (point y of input data) the weighted mean amount of groundwater available, and dividing by the representative well yield (point q of input data). The number of additional wells is computed by deducting the number of existing wells.

**t) Maximum Annual Supply Capacity**

Equals the average well yield, multiplied by the total number of wells (existing plus additional).

**u) Peak Month Supply Capacity**

The entered peak month percentage (point s of input data) is multiplied by the annual supply capacity.

**v) Total Available for Irrigation**

The total amount of water available for irrigation is the sum of surface water availability (point c above) and utilizable groundwater availability (point q above). This amount is then also divided by the CCA, to give the depth of water on farm from the combined use of surface and ground water.

**w) Reclaimable Sewage**

This is the product of the entered percentage of reclaimable sewage (point t of input data) and the net domestic water demand in cities and towns, which is computed as the gross demand (entered at the beginning of the worksheet) less system losses (entered as return flows).

**x) Investments**

1) Pumping equipment: the unit cost per $m^3$/sec per m head is multiplied by the discharge and the planned pumping head, to give the total cost of the pumping equipment, in Rs. Million.
2) Discharge main: the unit cost per m3/sec per km length is multiplied by the pumping station discharge and the length of the discharge main.
3) Investments in irrigation systems are made up of: (i) improvements, estimated as the product of the CCA and a unit cost of improvements per ha, and (ii) expansion of the CCA, again estimated as the product of the new CCA and a cost per hectare.
4) Well construction and pumps for wells: number of additional wells multiplied by the unit cost of construction, and by the cost of a pump per well.
5) Drainage System: area to be drained multiplied by cost per ha of introducing a drainage system
6) Total investment cost: total of all the costs, whether entered directly or calculated in the worksheet.

**y) Annual Operation and Maintenance (O&M) Costs**

1) New civil works: the entered percentage is multiplied by the total investment in this category
2) New CCA: if it is planned to increase the project's CCA, the additional CCA is multiplied by a rate of O&M cost per ha
3) Pumps: the entered percentage is multiplied by the total investment in pumps
4) Energy costs:
   - Groundwater: Cost per $m^3$ multiplied by the weighted average amount of groundwater available for irrigation (point q above);
   - Surface water (in lift schemes): cost per m3 per second multiplied by the weighted mean annual amount lifted
   - pumping from canals: total cost of lifting water from project canals to extended command areas at higher elevations
   - total mean annual energy costs: sum of all energy costs
5) Total annual O&M costs - sum of all annual costs, whether entered directly or calculated by the Worksheet (excluding investment costs).

## 5.4 Weights of Dependability Levels

In line with the project ToR, four climatic states are considered, with dependabilities of 90%, 75%, 50%, 25%. For various calculations it is necessary to give a weighted mean of variables computed for the four dependabilities. This is done by assigning weights to the four dependability levels.

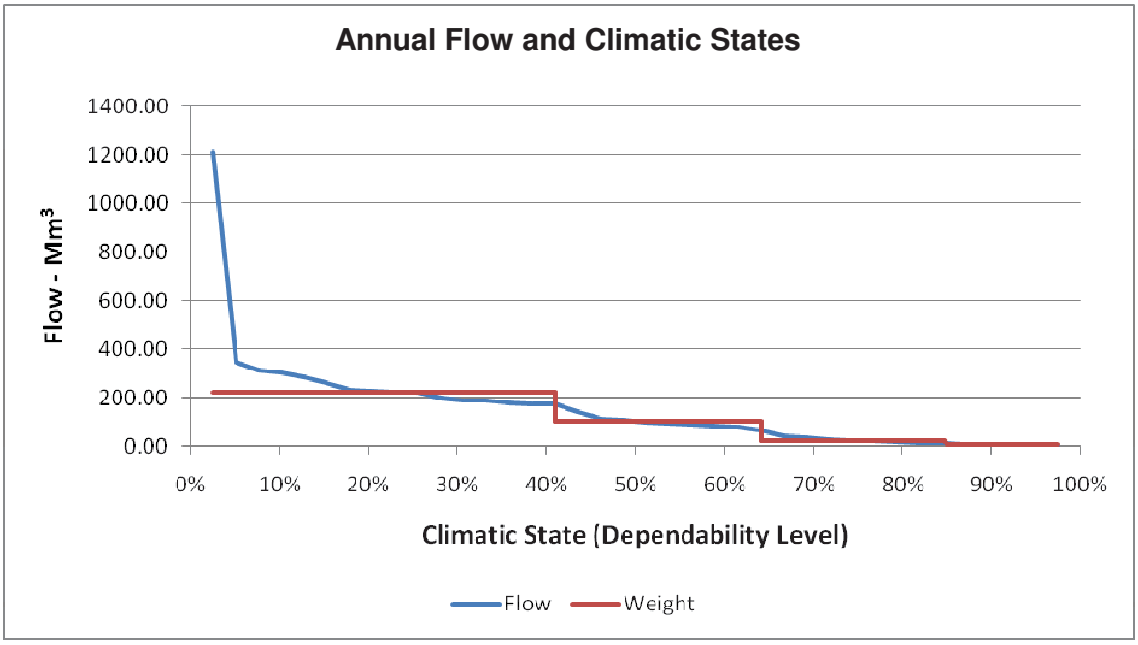
These weights may be different from one project to another, depending on the shape of the probability curve of the annual surface flows, as explained below.

For instance, based on an analysis of the stream flow series generated by the SWAT model for Jaisamand project, the following weights have been adopted:

| Climatic State Dependability | Weight |
|---|---|
| 90% | 0.150 |
| 75% | 0.210 |
| 50% | 0.230 |
| 25% | 0.410 |

This is an approximate step-wise representation of the descending probability distribution curve of Jaisamand Project annual flows, as depicted in Figure A2-1 below.

Figure A2-1 Jaisamand Project - Annual Stream flows and Climatic States




## 5.5 Linkage with the CMLP

### *5.5.1 General*

Section VII of the project planning worksheet (see sample in Annex 4) includes values abstracted from preceding sections for use as an input to the Crop Mix Linear Programming (CMLP) model, as well as values retrieved from the CMLP and results of the cost-benefit analysis performed within the planning worksheet. The CMLP model uses the data given in the abstract from the planning sheet of individual projects to find

the crop mix which maximises the project benefits under the water availability constraints, using for this purpose the crop water requirement functions, the CCA limitation and the crop budget data and a constraint of minimum and maximum area per crop. The project benefits are then entered in the planning worksheet and used for computing various cost-benefit indicators, as explained in the following paragraphs. All these values are computed for the with-plan and without-plan situations of the project (called Project Profiles) in the case of existing projects.

### *5.5.2 Input Data to the CMLP*

This section of the worksheet contains, in addition to project identification details, an abstract of the following results which are computed in preceding sections:

a) Cultivable command area (CCA);
b) On farm irrigation efficiency values for surface and groundwater irrigation;
c) Gross surface water available for irrigation at each dependability;
d) Groundwater available for irrigation at the four climatic states;
e) Firm annual amount of groundwater available for Kharif irrigation where aquifer regulation is assumed not possible (Aquifer Category B at the top of the worksheet); in this case the firm annual amount of groundwater (including return flows) which can be available for Kharif irrigation is taken as limited to the annual groundwater availability for irrigation at 90% dependability; if aquifer regulation is assumed possible this constraint on Kharif irrigation does not apply, and instead the next point applies;
f) Mean multi-annual groundwater supply: when aquifer regulation is assumed to be possible (Aquifer Category A at the top of the worksheet), the weighted mean annual amount of groundwater available for irrigation is given (including all recharge components and the mining potential, if any); if aquifer regulation is not assumed possible (Aquifer Category B at the top of the worksheet), this mean is not applicable and is not given;
g) Peak annual and monthly groundwater supply capacity for irrigation, after reducing supply to higher priority sectors.

It should be noted in connection with point e above, that as a conservative measure in computing irrigation benefits, it was assumed, in the case of aquifers with no multi-annual regulative capacity, that even though groundwater availability for Kharif crops is known in advance, the crop water requirements would in practice be conservatively determined for the driest anticipated Climatic State (i.e. of 90% dependability). This implies that in this situation part of the groundwater potential (including return flows, as computed by the Project Planning Worksheet) remains unutilised in the other Climatic States, because the crop water requirements in the other Climatic States are lower. On the other hand, the annual pumping capacity assumed for the calculation of the cost of new wells, is much higher (taken as 130% of the weighted average annual groundwater availability).

This approach is justified by two considerations: a) that in the long run groundwater utilisation would increase in any case, and more area would be irrigated at an increased irrigation intensity, as farmers would attempt to make higher and higher use of groundwater to increase irrigation benefits; b) that the higher investment and

operational costs of a larger number of wells are necessary in order to control groundwater levels and prevent their further rise.

### *5.5.3 CMLP Results*

This section of the worksheet receives the main output from the CMLP run which is necessary for the cost-benefit analysis of the project, i.e. the computed expected annual weighted mean benefit for the seven profiles: present (2010) and two each (with and without plan) in every subsequent Planning Stage.

In addition, for information only, this section also presents two sets of results from the CMLP: irrigation intensity and groundwater utilisation, both given for the four dependability levels and all the seven project profiles.

## 5.6 Cost-Benefit Analysis

With the figures of project investments and annual costs, derived from the planning worksheet, and the computed irrigation benefits derived from the CMLP, this section of the worksheet computes and presents the parameters described below.

**a) Periods**

Data required for discounting and present value computations are calculated from the nominal Planning Stage years 2010, 2020, 2040, 2060.

The year of completion of project investments and start of project operation related to each of the Planning Stages, is taken halfway between the said nominal Planning Stage years, i.e. 2015, 2030 and 2050.

The end of each period is the start of next period, except of the last period for which the nominal Planning Stage year is assumed to be in the middle of the period, consequently giving the end of the last period as year 2070.

According to this principle the length of each period and its starting time are computed, as shown in the following table.

| Planning Stage | Investment Completed | Operation Period | | Length, years | Years from Start |
|---|---|---|---|---|---|
| | | Starts | Ends | | |
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

**b) Annual Costs and benefits**

**(i) Annuity capital costs**

Annuity capital cost is the annuity equivalent of an investment, computed in two stages. First, the investments given in section V of the worksheet are increased by calculating capital costs, or interest during construction. For this purpose it is assumed that the investments are evenly spread over the construction period, which may be different for different types of structure, as shown in section V of the worksheet (see point u of input data). The interest costs during construction are added to the construction costs. Second, the increased investments are converted to equal annual costs over the years of

the Depreciation Period (given in section V of the worksheet), and these annual costs are presented as Annuity Capital Costs in the first row of this section.

**(ii) Total costs**

These are the sum of the annuity capital costs, as given above and the total O & M costs computed in section V of the worksheet.

**(iii) Irrigation allocated annuity capital cost**

The share of priority sectors in project components and structures which supply water for both irrigation and priority demands (like the dam and appurtenant civil structures, pumping equipment, discharge main) is computed, on the basis of the respective annual amounts of water supplied, and the total annuity capital cost is reduced in that proportion, to give the annuity capital cost attributed to irrigation only.

**(iv) Irrigation allocated annuity project costs**

The share of irrigation in the annual O&M costs is computed on the same basis as explained in the preceding point, and added to the irrigation allocated annuity capital costs, to give the total annuity project costs attributed to irrigation only.

**(v) Weighted mean annual irrigation benefits**

- As obtained from the CMLP.

**(vi) Weighted mean net available irrigation water**

- weighted mean of net annual amounts of water available for irrigation at four dependabilities, calculated by applying on-farm efficiency to the gross amount of irrigation water available on farm, from SW and from GW

**(vii) Weighted mean gross available irrigation water on farm**

- weighted mean of gross annual amounts of water available for irrigation on farm at four dependabilities, as computed from the input data to the CMLP model

**(viii) Weighted mean surface water to priority sectors**

- weighted mean annual surface water supply to priority sectors, as computed in section IIIa of the worksheet

**c) Present Values**

This section of the worksheet includes the present value of annual figures computed in the preceding section, with and without plan, and the differences between these two situations - for existing projects only. The present values of the following factors are computed and presented:

(1) Total water supply from the project, in $Mm^3$
(2) Gross on-farm irrigation water supply, in $Mm^3$
(3) Water supply to priority sectors, in Mm3
(4) Weighted mean irrigation benefits, in million Rupees
(5) Total project costs, in million Rupees
(6) Project capital costs, in million Rupees
(7) Irrigation allocated total costs, million Rupees
(8) Irrigation allocated capital costs, million Rupees
(9) Irrigation net present value (NPV), million Rupees = (4) - (7)

**d) Economic Indicators**

The following economic indicators, which are subsequently used for project ranking, are presented in the last section of the worksheet:

(1) Total cost per unit of water, Rs./$m^3$, with and without plan = (7) / (2)
(2) Priority sector water utilisation, in %, with and without plan = [(3) / (1)] × 100
(3) Capital costs allocated to irrigation, per hectare of CCA = (8)/CCA (with plan)
(4) Benefit/cost (B/C) ratio, defined as: irrigation benefits

$$\text{Divided by total irrigation costs} = \frac{(4)with - (4)without + (7)without}{(7)with}$$

(5) Irrigation net benefits defined as NPV + capital irrigation cost

$$\text{divided by capital irrigation costs} = \frac{(4)difference + (8)with}{(8)with}$$

i.e. (irrigation benefits - O&M) / capital costs

## 6. Prioritization of Projects

Long-term decisions by the Government of Rajasthan on investing in irrigation projects should be based on priority considerations, as well as budget and implementation capacity constraints. These considerations can be based on quantifiable as well as non-quantifiable attributes of the projects under consideration, and various persons or authorities, in considering their preferences, may assign different weights to the various attributes of the identified projects.

As an aid to this process of decision making, the Consultants present a priority ranking table, as presented below (Table A2-1), based on the engineering and economic studies of irrigation projects.

The rank order numbers of every quantifiable attribute within each of the project categories simply indicate the place of the numerical value of that attribute in the list of projects when this list is arranged in a descending or ascending order of the values of the attribute concerned (depending on the nature of the attribute).

The quantifiable attributes include the following:

(1) Benefit/cost (B/C) ratio - taken from the Project Planning Worksheet;
rank number 1 = highest B/C ratio;
(2) Cost of supply per unit of water - from the Project Planning Worksheet;
rank number 1 = lowest cost of water;
(3) Cultivable command area (CCA) - from the Project Planning Worksheet;
rank number 1 = highest value;
(4) Present value (PV) of investments per hectare - from the Project Planning Worksheet;
rank number 1 = lowest PV;
(5) Percentage supply to priority sectors - from the Project Planning Worksheet;
rank number 1 = highest percentage;
(6) Submergence area (for expansion only) - from the project's design report;
rank number 1 = lowest submergence;

(7) Project age, in the case of improvement of existing projects only - since year of commissioning;
rank number 1 = oldest project;

The non-quantifiable attributes include:

(1) Supply to disadvantaged social sectors, such as Scheduled Tribes (ST) and Scheduled Castes (SC) - from the project's design report;
rank number 0 = yes, if there is such a supply component in this project; otherwise = 1;
(2) supply to drought-prone areas (DPA) - from the project's design report; rank number 0 = yes, if this is a DPA; otherwise = 1.

The following is a brief explanation of the said attributes.

The B/C ratio, i.e. weighted mean irrigation benefits divided by the annuity equivalent of total project cost (investment and annual O&M), and the project cost per unit of water, are taken from the planning worksheet of individual projects.

The present value of investments per hectare is also a direct result of the planning worksheet, taking the present value of the difference in investments between the with and without plan situations, and dividing it by the CCA.

Percentage supply to priority sectors is the weighted mean possible annual supply to urban and rural domestic and livestock consumers, and to industries, linked to or located within the project's command area, as computed in the worksheet for the ultimate Planning Stage, divided by the weighted mean of the total amount of water supplied annually, to irrigation and other sectors together, in the ultimate Planning Stage. It is important to note that irrigation projects with a predominant component of domestic or industrial supply (to existing industries) should receive a higher priority, and therefore need not be ranked together with other irrigation projects.

Supply to disadvantaged social sectors - indicating whether a project is or is not supplying irrigation or drinking water to areas inhabited or cultivated by Scheduled Tribes or Scheduled Castes or backward classes, and Tribal areas, as defined by the government authorities.

Supply to drought-prone areas - indicating whether a project is or is not supplying irrigation or drinking water to drought-prone areas, as defined by the government authorities.

Table A2-1 Sample Priority Ranking Table

| S. No. | Project | | Benefit/ Cost | | Cost of Water | | CCA | | PV of Investments (per ha) | | PV of added supply for Priority Sectors | | Submergence Area | | Age | | ST, SC 1=No 0=Yes | DPA 1=No 0=Yes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name | Class | Ratio | Rank | Rs./$m^3$ | Rank | ha | Rank | Rs. | Rank | $m^3$ | Rank | $km^2$ | Rank | Years | Rank | | |
| | Set weights "A": Economic benefit approach | | 2 | | 2 | | 1 | | 2 | | 1 | | 1 | | 1 | | 1 | 1 |
| | Set weights "B": Social approach | | 1 | | 1 | | 1 | | 1 | | 2 | | 1 | | 1 | | 2 | 2 |
| | A. Improvements in Existing Projects | | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Value |
| 1 | Arwar | Medium | 2.38 | 11 | 0.66 | 16 | 7,394 | 11 | 7,591 | 18 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 2 | Badgaon | Medium | 0.95 | 26 | 1.52 | 31 | 6,797 | 12 | 7,056 | 14 | 0 | 1 | 0 | 1 | 44 | 23 | 0 | 1 |
| 3 | Bagolia | Medium | 0.29 | 35 | 5.44 | 35 | 3,676 | 23 | 7,691 | 24 | 0 | 1 | 0 | 1 | 54 | 12 | 0 | 1 |
| 4 | Bassi | Medium | 3.86 | 1 | 0.40 | 5 | 3,250 | 26 | 6,202 | 4 | 0 | 1 | 0 | 1 | 24 | 32 | 0 | 1 |
| 5 | Bhupal sagar | Medium | 0.93 | 27 | 1.32 | 29 | 3,873 | 22 | 9,310 | 26 | 0 | 1 | 0 | 1 | 74 | 9 | 0 | 1 |
| 6 | Bilas | Medium | 2.34 | 12 | 0.38 | 4 | 5,863 | 16 | 5,725 | 3 | 0 | 1 | 0 | 1 | 15 | 35 | 0 | 1 |
| 7 | Chandrabhaga | Medium | 1.65 | 19 | 1.29 | 28 | 3,342 | 25 | 7,691 | 21 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 8 | Chandsain | Medium | 1.93 | 17 | 0.85 | 19 | 2,600 | 30 | 11,646 | 35 | 0 | 1 | 0 | 1 | 130 | 2 | 0 | 1 |
| 9 | Chaparwada | Major | 0.78 | 32 | 1.54 | 32 | 11,745 | 6 | 9,793 | 30 | 0 | 1 | 0 | 1 | 116 | 5 | 0 | 0 |
| 10 | Dheel | Medium | 1.25 | 22 | 1.00 | 25 | 5,943 | 15 | 9,950 | 31 | 0 | 1 | 0 | 1 | 99 | 7 | 0 | 1 |
| 11 | Dindoli | Medium | 2.96 | 6 | 0.64 | 15 | 2,056 | 34 | 7,146 | 16 | 0 | 1 | 0 | 1 | 45 | 22 | 0 | 1 |
| 12 | Dugari | Medium | 2.16 | 13 | 0.59 | 13 | 2,251 | 32 | 7,691 | 20 | 0 | 1 | 0 | 1 | 55 | 11 | 0 | 1 |
| 13 | Galwania | Medium | 3.64 | 2 | 0.53 | 12 | 2,257 | 31 | 8,289 | 25 | 0 | 1 | 0 | 1 | 56 | 10 | 0 | 1 |
| 14 | Gopalpura | Medium | 0.50 | 34 | 0.28 | 1 | 3,557 | 24 | 6,652 | 10 | 0 | 1 | 0 | 1 | 30 | 27 | 0 | 1 |
| 15 | Jaisamand | Major | 1.23 | 23 | 0.40 | 7 | 16,000 | 4 | 11,484 | 34 | 0 | 1 | 0 | 1 | 280 | 1 | 0 | 1 |
| 16 | Jakham | Major | 2.94 | 7 | 0.36 | 2 | 28,308 | 2 | 5,452 | 1 | 0 | 1 | 0 | 1 | 24 | 32 | 0 | 1 |
| 17 | Kalisil | Medium | 1.21 | 24 | 0.44 | 8 | 4,700 | 18 | 7,691 | 22 | 0 | 1 | 0 | 1 | 54 | 12 | 0 | 1 |
| 18 | Khari | Medium | 2.70 | 9 | 0.70 | 18 | 6,478 | 13 | 7,591 | 17 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 19 | Kothari | Medium | 2.73 | 8 | 0.46 | 9 | 4,395 | 20 | 6,202 | 5 | 0 | 1 | 0 | 1 | 21 | 34 | 0 | 1 |
| 20 | Lassadia | Medium | 3.27 | 4 | 0.48 | 10 | 2,080 | 33 | 6,652 | 9 | 0 | 1 | 0 | 1 | 30 | 27 | 0 | 1 |
| 21 | Madhosagar | Medium | 1.78 | 18 | 0.88 | 21 | 3,232 | 27 | 11,398 | 32 | 0 | 1 | 0 | 1 | 123 | 3 | 0 | 1 |
| 22 | Mahi Bajaj | Major | 2.14 | 15 | 0.40 | 6 | 80,000 | 1 | 9,464 | 27 | 0 | 1 | 0 | 1 | 27 | 30 | 0 | 1 |
| 23 | Mataji Ka Khera | Medium | 3.13 | 5 | 0.86 | 20 | 3,057 | 28 | 7,691 | 19 | 0 | 1 | 0 | 1 | 52 | 19 | 0 | 1 |
| 24 | Meja | Major | 1.53 | 20 | 1.07 | 26 | 20,714 | 3 | 6,693 | 12 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 25 | Murlia | Medium | 3.44 | 3 | 0.38 | 3 | 1,323 | 35 | 7,146 | 15 | 0 | 1 | 0 | 1 | 43 | 25 | 0 | 1 |
| 26 | Narain Sagar Jalia | Medium | 0.82 | 31 | 2.39 | 34 | 4,087 | 21 | 7,691 | 23 | 0 | 1 | 0 | 1 | 43 | 25 | 0 | 1 |
| 27 | Rajsamand | Major | 2.14 | 14 | 0.98 | 24 | 10,450 | 7 | 6,693 | 11 | 0 | 1 | 0 | 1 | 47 | 20 | 0 | 1 |
| 28 | Sardar Samand | Major | 1.95 | 16 | 0.91 | 22 | 10,325 | 8 | 6,448 | 6 | 0 | 1 | 0 | 1 | 106 | 6 | 0 | 0 |
| 29 | Sareri | Medium | 0.93 | 28 | 0.95 | 23 | 9,717 | 9 | 5,508 | 2 | 0 | 1 | 0 | 1 | 53 | 14 | 0 | 1 |
| 30 | Somkagdar | Medium | 0.88 | 29 | 0.49 | 11 | 5,739 | 17 | 6,569 | 8 | 0 | 1 | 0 | 1 | 27 | 30 | 0 | 1 |

| S. No. | Project | | Benefit/ Cost | | Cost of Water | | CCA | | PV of Investments (per ha) | | PV of added supply for Priority Sectors | | Submergence Area | | Age | | ST, SC 1=No 0=Yes | DPA 1=No 0=Yes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name | Class | Ratio | Rank | Rs./$m^3$ | Rank | ha | Rank | Rs. | Rank | $m^3$ | Rank | $km^2$ | Rank | Years | Rank | | |
| **31** | Tordi Sagar | Major | 0.87 | 30 | 1.50 | 30 | 13,960 | 5 | 9,793 | 29 | 0 | 1 | 0 | 1 | 122 | 4 | 0 | 1 |
| **32** | Udai Sagar | Medium | 0.73 | 33 | 1.22 | 27 | 4,650 | 19 | 11,411 | 33 | 0 | 1 | 0 | 1 | 46 | 21 | 0 | 1 |
| **33** | Ummed Sagar | Medium | 1.51 | 21 | 0.67 | 17 | 2,968 | 29 | 9,690 | 28 | 0 | 1 | 0 | 1 | 93 | 8 | 0 | 1 |
| **34** | Vallabhnagar | Medium | 1.08 | 25 | 1.85 | 33 | 6,464 | 14 | 7,056 | 13 | 0 | 1 | 0 | 1 | 44 | 23 | 0 | 1 |
| **35** | Wagan | Medium | 2.67 | 10 | 0.60 | 14 | 8,270 | 10 | 6,569 | 7 | 0 | 1 | 0 | 1 | 28 | 29 | 0 | 1 |

# Annex 3

# Assessment of Irrigation Benefits

# Annex 3

# Assessment of Irrigation Benefits

## 1. General

This Annex describes the procedure developed by the Consultants for the assessment of the irrigation benefits which enter the computation of economic viability indicators of projects, in order to enable their prioritisation on economic grounds. Annex 2 describes the Consultants' methodology for assessing project costs and how the computed benefits are incorporated in the computation of the economic indicators.

To assess the irrigation benefits, the crop mixes that would give the highest benefits from individual projects, given the project's constraints on availability of water and land, were computed as part of the economic analysis.

A simplified linear programming (LP) procedure was developed by the Consultants for this purpose, which includes crop production, income and cost data representing different regions, agroclimatic conditions and climatic states, as well as the amount of culturable command area (CCA) and water availability conditions in the analysed project.

The computational model described below analyses the relation between varying irrigation water supply conditions in the project, in monthly units, and the agricultural production, thus simulating the response of the farmers to irrigation water supply conditions. By changing the water supply conditions by improving the performance of existing projects, and computing the resulting changes in agricultural production and farm income, it is possible to assess the economic viability of improvement plans.

The Crop Mix Linear Programming model (CMLP) aims at finding the crop mix which maximizes farm net income under varying constraints on irrigation water availability. The main components of the model are:

- Water supply and demand
  - Water Supply
    - Surface water from reservoirs
    - Surface water by pumping from the run of the river (so-called lift irrigation)
    - Ground water
  - Water demand by crops
- Land supply and demand and crop constraints
  - Available irrigable land
  - Land occupancy by crops
  - Special constraints on crop areas
- Cost of water and income:
  - Cost of water
    - Cost per $m^3$
    - Cost per ha
  - Farm income
  - Total net income

The response of the farming community to various water availability conditions involves decision making under uncertainty with regard to climatic conditions. To analyse the response of farmers to irrigation water conditions under uncertainty, it is assumed that the climatic probability distribution is represented by four climatic states, or dependabilities, each assigned a probability of occurrence. The four climatic states are denoted in the computational model by State1, State2, State3 and State4, corresponding to dependabilities of 90%, 75%, 50% and 25%, respectively. It is further assumed that, based on past experience, the probabilities, or weights, of the climatic states are known, and the objective is to maximise the mean, or weighted average, of farm incomes. Accordingly, the model includes four sets of water supply conditions, corresponding to the four climatic states with their four probabilities, or weights. The main variables to be determined by the model are four sets of cropped areas, corresponding to the four irrigation water conditions related to the four climatic states.

There are two main cropping seasons, namely Rabi and Kharif. For the Rabi season, at the time of deciding on crop sowing most of the rain has already fallen, the amount of water available for irrigation from the project's storage reservoir is known in advance, and the decision on Rabi crops is a decision under certainty. Only small amounts of rain are expected during the growing season itself, and for practical purposes the water requirement of the sown Rabi crops does not depend on the rainfall during the season.

On the other hand, both the supply and the demand for irrigation water for Kharif crops depend on the climatic conditions during the cropping season. The degree of certainty existing at the time of decision making on the Kharif crops, with respect to the water supply conditions, depends on the type of water source.

It is very important to distinguish between the crop mixes computed by the model and any real crop mix that could be planned or recommended for actual implementation. The Consultants have merely attempted in this study to achieve as close as possible an economically realistic representation of the main crops, their cultivation and production costs and incomes, and this - solely for the purpose of reliably assessing the benefits which can be attributed to the improvement of irrigation projects.

# 2. Water Supply and Demand

## 2.1. Water Supply

### *2.1.1. Introduction*

The water supply side of the model is composed of two sources of irrigation water, namely: surface water and ground water. The following paragraphs describe the differences in model formulation which represent the water supply conditions from these two sources and variants of their utilisation.

### *2.1.2. Surface Water Supply*

Surface water supply is represented in the model as follows:

In the CMLP model, four sets of 12 values of monthly amounts of water inflow are included, each set corresponding to one of the four climatic states. Water available in one month can be carried over to the next month. This is represented in the model by inter-monthly water transfer variables, the values of which are to be determined by the optimization procedure. Practically, due to high evaporation losses, and economically,

it is not feasible to store water from one year to the next, and therefore surface water is normally used by Rabi crops, not by Kharif crops, which are sown at the beginning of the next Monsoon. Thus, for planning purposes it is not necessary to enter monthly inflow data for each month of the rainy season; it is sufficient to enter the accumulated inflow available in the reservoir in October.

In addition to the 12 inflow values there are conveyance capacity constraints, which express the maximum monthly amount of water that can be conveyed by the distribution system to the irrigated area.

### *2.1.3. Lift Irrigation (run-of-the-river)*

In lift irrigation projects, the source of water is a river or a major canal. Water from this source is available all the year around and is pumped up to the irrigated areas. In general, the flow is unstable and varies seasonally and annually. Projecting the amounts of water is uncertain, since the variability of water supply is a result of the variability of climatic conditions in the catchment area of the river. However, at the time of deciding on areas to be sown in the coming agricultural season, it is possible to assess the availability of water at a high degree of certainty, based on several indicators which can be known, like the current flow in the river and the recent climatic conditions in the catchment area.

The formulation of water supply conditions in a lift irrigation model is similar to the basic surface water case, with certain modifications. The model includes four sets of twelve monthly inflows, each set corresponding to one of the four climatic states. However, in this case there is no reservoir, and water available in one month cannot be carried over to the next month like in the case of a surface water storage project. No inter-month water transfer variables are therefore included in the model. The twelve monthly values of available water enable both Rabi and Kharif crops to be grown. The lift irrigation case can be viewed as a special sub-case of the surface water case, with four sets of twelve monthly water inflows but without inter-month water transfer variables.

### *2.1.4. Groundwater*

There are two types of constraints regarding groundwater: a maximum allowable annual pumping and a maximum monthly pumping capacity. The first is a hydrological constraint, while the latter is a physical constraint, representing the pumping capacity of wells.

Two cases are distinguished with regard to the regulative capacity of the aquifer (see Annex 2):

- in case long-term aquifer storage regulation is possible, the constraint on allowable annual pumping is taken as the multi-annual average, meaning that it is possible to use more water in a dry year and less in a plentiful year, provided the weighted average annual pumping does not exceed the multi-annual average availability of groundwater;
- in case such a regulation is not possible, the amount of allowable annual pumping changes according to the climatic state, groundwater cannot be carried over from year to year, and the annual recharge can be used only in the same year. Accordingly, in the no-regulation case, four different amounts of allowable

groundwater pumping, corresponding to the four climatic states, substitute the one average annual constraint in the regulation case.

In addition to these hydrological constraints, a peak month pumping capacity constraint and an annual constraint on pumping capacity are included in the CMLP model, representing the physical pumping capacity of wells.

The groundwater CMLP application includes twelve monthly pumping variables and an annual water constraint. Four sets of monthly pumping variables can be specified, corresponding to the four climatic states.

The annual constraint depends on the type of aquifer. In the regulated groundwater case there is one multi-annual water constraint in the model, which implies that water can be used flexibly (as represented by the pumping variables), provided the average annual water pumping, weighted by the four climatic state probabilities, does not exceed the constraint on the multi-annual mean.

In contrast, in the non-regulated aquifer case there are four annual groundwater constraints, representing the annual aquifer recharge corresponding to each of the four climatic states.

### *2.1.5. Conjunctive Use*

The CMLP version developed for the case of conjunctive use of surface water (or lift irrigation) in combination with groundwater, includes elements of these two sources.

There are four different combinations of conjunctive use: surface water or lift irrigation together with regulated or unregulated groundwater. We denote these combinations as follows:

SY= Surface water and groundwater with - Yes - regulation
SN= Surface water and groundwater without - No - regulation
LY= Lift irrigation and groundwater with - Yes - regulation
LN= Lift irrigation and groundwater without - No - regulation.

One of the sources can be zero, representing a case of a single source system, either surface water or lift irrigation or ground water, so there is no need for additional notation.

## 2.2. Water Demand and Treatment of Uncertainty

### *2.2.1. General*

The water demand side of the model comprises a table of monthly crop water requirements per hectare and an equation which calculates the total monthly and annual demand by multiplying the water requirements table by the crop areas.

In the CMLP model, the water requirements table is composed of four sub-tables, corresponding to the four climatic states. The need for four sub-tables - follows from the fact that the irrigation water requirements generally differ according to the climatic conditions, and the per-hectare values are generally higher in a dry year. This reflects the fact that in dry years not only the supply of water is lower, but also the demand for water is higher. This is mainly true for the Kharif crops, and only to a small extent relevant to the Rabi crops, the irrigation water demand of which does not change much with the climatic conditions. Obviously, the uncertainty with regards to climatic

conditions is reflected in an uncertainty about irrigation water demands, mainly for the Kharif crops.

The model is designed to maximise the average net income from crops, given land and water supply constraints. It is aimed to simulate the decision making on irrigated crop areas in the two seasons. Although risk is not explicitly included in the model, a conservative approach is applied in planning the Kharif crop areas.

The combination of the different water supply types described above and the two cropping seasons creates different cases of uncertainty and requires different model applications to analyse these cases. A general conservative approach is adopted to avoid situations in which water supply is insufficient to fulfil all the irrigation water demand of the Kharif crops.

This means that in most cases Kharif crops areas would be planned on the basis of the highest irrigation water requirements (for a 90% dependable climatic state) and on firm water supply (dependability 90%). This ensures that even in the worst climatic state, there would be enough water to irrigate all the planned Kharif area.

However, in case the water supply can be regulated by utilizing the storage capacity of an aquifer, thus enabling more groundwater to be used in dry years and less in wet years, the assumption of planning on the basis of the highest irrigation requirements would be relaxed.

In the following paragraphs the implications of the various combinations of water supply sources are analysed, and the model applications suitable for treating each case are described.

### *2.2.2. Case 1: Surface Water Projects*

As described in para. 2.1.2 above, in surface water irrigation projects water accumulates in the reservoir up to end of October and can then be carried over from month to month, but cannot be stored for the next year. This means that according to the conservative approach adopted, Kharif crops cannot be based on surface water.

As for the Rabi crops, water availability is known at the decision point (October), since the amount of water in the reservoir is known and no substantial rain is expected during the growing season. Maximum average income would be achieved if the income is maximized separately and independently for each climatic state (with known amounts of stored water).

### *2.2.3. Case 2: Lift Irrigation Projects*

As discussed in para. 2.1.3 above, in the case of lift irrigation it is possible to assess before the cropping season, with a high degree of certainty, the amounts of water which would be available for irrigation. However, the irrigation water requirements of the Kharif crops remain uncertain, because they depend on the unknown climatic state that would prevail in the Kharif season. Since there is no reservoir to regulate the water supply, the conservative approach adopted is to avoid the possibility that there would be insufficient water to fulfil the crop requirements. Consequently, for design purposes, the highest Kharif irrigation water requirements are taken into account in this case.

As mentioned in para. 2.1.3 above, the water supply side in the case of a lift irrigation project, is represented in the model by four sets of monthly inflows, corresponding to

the four climatic states. Since at the time of decision the availability of water in the growing season can be assessed with a high certainty for each of the climatic states, the crop areas can be planned separately and independently for each state, taking into account the highest crop water requirements. Accordingly, there would be four Kharif crop growing plans as well as four Rabi plans.

### *2.2.4. Case 3: Groundwater Projects*

- Case 3a: Groundwater projects with regulative capacity

In this case the multi-annual mean aquifer recharge is the relevant water supply constraint, rather than the different recharge rates in the different climatic states (including irrigation return flows). In view of the possibility of regulating the groundwater supply, there is no reason to apply the conservative approach of planning the Kharif crops on the basis of highest water requirements. In dry years, when irrigation water demand is higher, water supply can be increased, on account of reducing water supply in plentiful years. In fact, in the case of regulated groundwater the decision on Kharif crops is not affected by the current climatic state. For this reason there would be only one Kharif plan, irrespective of the climatic state, provided that the multi-annual mean (i.e. the weighted average) water demand would not exceed the mean annual recharge.

In terms of model formulation, this case is characterized by one Kharif crops plan, not four.

- Case 3b: Groundwater projects without regulative capacity

Non regulation means that the annual recharge (including irrigation return flows), which depends on the climatic state, should be utilised in the same year, from October to September. The model assumes that at the beginning of the year the aquifer is already recharged, and it is therefore possible at this time to plan both the Rabi and the Kharif crops. Since the annual water stock is known in advance in this case, the amount of groundwater remaining for the Kharif season is also known according to the Rabi plan. The only uncertainty at this time is the irrigation water requirements of the Kharif crops, which depend on the unknown climatic state that would prevail in the Kharif growing season. But this would also be unknown even closer to the Kharif season. Therefore, it is possible in this case to plan both Rabi and Kharif crops in October. Following the conservative approach adopted, the plan of Kharif crops would in this case be based on the highest crop water requirements, and four Kharif plans would be included in the model, one for each climatic state.

### *2.2.5. Case 4: Conjunctive Use of Surface and Ground Water*

This case is a combination of the relevant single source cases. Similar to the surface water case, surface water can only be used for Rabi crops, since Kharif crops are to be given only reliable water supply. In contrast, groundwater is available for both groups of crops. Similar to the surface water case, only the information on the amount of water accumulated by the month of October is required for the solution, and water can be carried over to the following months. The groundwater component can be with or without a regulative capacity, as explained below.

- Case 4a: Conjunctive use of surface water and regulated groundwater

As in the case of a single source with regulated groundwater, only one Kharif plan would be planned, because the Kharif plan does not depend on aquifer recharge in a particular year but rather on the multi-annual mean recharge (including return flows). In contrast, there would be four Rabi crop plans, each based on the climatic state which determines the amount of surface water in the reservoir in October. In all, the four Rabi plans and the one Kharif plan with its variable irrigation water demand (represented by four sets of crop water requirements), should satisfy the constraint that the mean total irrigation water demand cannot exceed the mean total supply of the two sources.

- Case 4b: Conjunctive use of surface water and unregulated groundwater

This case includes the components of the corresponding single source cases. As stated above, at the time of deciding on the Rabi crops, all the information on water availability in the current year would be known in such a case. Moreover, the amount of groundwater remaining for the Kharif season is determined by the Rabi plan, which also affects groundwater recharge by irrigation return flows. The only unknown factor at the time of decision is the Kharif irrigation water requirements. Applying the conservative approach of using for planning the highest irrigation water requirements, it is possible to plan both the Rabi and the Kharif crops. In this case there would therefore be four crop plans for each season, corresponding to the climatic states which determine the availability of water, known at the time of decision.

### *2.2.6. Case 5: Conjunctive Use of Lift Irrigation and Groundwater*

This combines the two cases of lift irrigation and groundwater. Both of the sources can be used for Rabi and Kharif crops. Two sub-cases should be distinguished, according to the type of groundwater storage being with or without regulative capacity.

- Case 5a: Conjunctive use of lift irrigation and regulated groundwater

The combination of lift irrigation with regulated groundwater is somewhat complicated, as there are two sources of water available for Kharif crops, one is flexible (regulated groundwater), while the other (the lift source) is not. In a special case in which one of the two sources is dominant, the model reflects the dominant source.

In case the dominant source is regulated groundwater, there would be one Kharif plan, and the varying water demand and water supply from the river, due to the variable climatic states, would be supplemented from groundwater. The total demand for irrigation water should satisfy the constraint that the mean annual pumping from the aquifer cannot exceed the mean annual aquifer recharge, including irrigation return flows.

In the case the dominant source is the lift irrigation, the model application would be similar to the one for single source lift irrigation, i.e., there would be four Kharif plans corresponding to the four climatic states, and the highest crop water requirements would be taken into account for the purpose of planning. The formulation of groundwater supply would be similar to the regulated groundwater case, and the constraint limiting the mean annual pumping from groundwater to the mean annual recharge, applies.

- Case 5b: Conjunctive use of lift irrigation and unregulated groundwater

In the case of conjunctive use of lift irrigation and unregulated groundwater there is no flexibility of regulating the supply of water from either source. Therefore, in this case the conditions of the case of unregulated groundwater are applicable, with an additional unregulated source of water, i.e. the four sets of monthly surface water flows corresponding to the four climatic states. In this case, the conservative approach to uncertainty is applicable, which means that for planning purposes the highest crop water requirements are taken into account. The model application includes in this case four Rabi plans and four Kharif plans, corresponding to the four climatic states.

# 3. Land Supply and Demand

## 3.1. Available Irrigable Land

The total amount of irrigable land in a project's command area is given. In the optimal solution all the available land can be utilised, or, in case of an acute shortage of water, part of the land can be left un-irrigated. The model is formulated to ensure that for each month of the year no more than the available land will be occupied by crops.

## 3.2. Land Occupation by Crops

Land occupation by crops is represented in the model by a table of crop occupancy coefficients. In the CMLP model there are 12 monthly coefficients for each crop which can be either 1, in a month in which the crop occupies the land, or 0, in other months of the year.

## 3.3. Land Supply and Demand Constraints

The model includes a table of 12 monthly inequalities which ensure that in each month the area occupied by crops will not exceed the total irrigable area. The amount of land used in each month is computed by multiplying the land occupancy coefficients by the crop areas. However, the model allows crop intensity to be greater than one, where two crops can occupy the land in different months of the year, like Rabi and Kharif crops.

## 3.4. Special Constraints on Crop Areas

In addition to the water and land constraints discussed in the preceding paragraphs, special upper and lower bounds on crop areas are included in the model. These are formulated as minimum and maximum constraints on areas of groups of crops. There may be different reasons to apply such constraints.

A lower bound on the area to be planned for a certain group of crops may represent the need for a minimum production of basic food crops, or it can constitute the minimum area of a specific group of crops which is recommended in order to maintain agricultural sustainability.

Maximum area constraints may represent market constraints on special high value crops, like spices or fresh vegetables and fruits, or constraints which aim at preventing over-exploitation of the soil by some crops, or maintaining agricultural sustainability.

As mentioned above, the area constraints are defined in terms of groups of crops, but a constraint on the area of one crop is just a special case of a group constraint, where there is only one crop in the group.

# 4. Cost of Water and Income

## 4.1. The Cost of Water

Three types of water cost are included in the model: proportional to the area irrigated, proportional to the amount of groundwater used, and proportional to the amount of surface water used. The latter is relevant also to the case of lift irrigation. The cost proportional to the area can also be used to represent the annual cost of land or the opportunity cost of land, e.g. the benefit from rainfed farming.

Input data on water costs in irrigation projects are obtained from the project planning worksheet described in Annex 2.

## 4.2. Farm Income

The model includes coefficients of net income per hectare for the different crops, defined as the income remaining after deducting production costs from product value. The net income coefficients are based on detailed crop budgets, which are not part of the model itself (see section 7 below).

In the calculation of net income, water costs are not subtracted, as this cost can be taken explicitly into account either in the model itself (see paragraphs 4.1 and 4.3) or in the project's economic analysis, which forms part of the project's planning worksheet (see Annex 2).

The cost of pumping, either surface or ground water, and the cost of the project's operation and maintenance (including groundwater) is accounted for in the economic analysis performed by the project planning worksheet.

Total farm income is calculated in the model by multiplying the per-hectare income coefficients by the crop areas, which are variables to be solved by the model. In the CMLP model, the mean (weighted average) income is calculated as the sum of incomes at the four climatic states multiplied by their weights.

## 4.3. Total Net Income

Total net income is calculated in the model by subtracting the cost of water from the total farm income. The model searches for the crop area composition which maximizes the total net income, given the water and land constraints. In the model, the objective is to maximise the mean net income.

# 5. Model Application

## 5.1. General

As has been stated earlier, a decision on Rabi crops is generally made under conditions of certainty with regard to the availability of water, in advance of sowing. The model calculates the net income under the uncertainty of the water conditions.

In general, the analysis can be carried out either project-wise, or for typical case studies, or hypothetical cases, where one or several parameters can be gradually changed, and the results traced, to identify the general response of the studied typical case to changes in the model parameters.

However, in the course of analysing Major and Medium irrigation projects (see Annex 2) it was realised that it would be more efficient and easier to apply the model routinely to each of these projects, taking into account its specific water and land conditions.

### 5.2. The User's Interface Form

In applying CMLP to project analysis, it is necessary to run the model several times for each project, using the results of the project planning under the "with plan" and "without plan" conditions and at different planning stages. In addition, each project is characterised by the type of water supply, i.e. surface water, lift irrigation, groundwater with or without regulation. The water supply type, determines the adjustment which should be applied to the general CMLP, as discussed in section 2 above.

To facilitate the routine adjustment of the model to the specific type of project analysed, and for running it under different sets of assumptions, a user's interface was established. The user enters the specific data of the project and the different sets of assumptions, organised as project profiles, into the interface data form. A special program controls the repeated runs of the model. It makes the necessary adjustment in the model according to the type of water supply (see section 2 above), and then, for each profile, it transfers the data into the model, runs the model and reports the results back in the user's interface results form

### 5.3. Analysis of Benefits from Increasing Irrigation Efficiency

An increase in irrigation efficiency can be expressed in terms of an increase in the amount of water available per hectare of irrigable land. Thus, the agricultural benefit from increased efficiency can be directly estimated by comparing, through the CMLP model, the results of with- and without-improvement situations.

However, it should be noted that such an estimate of the benefit from increasing irrigation efficiency is to be adjusted to allow for the loss of benefit due to the decrease of return flows, if these can be utilized by wells.

## 6. Economic Criteria Applied

As the economic analysis is related to a long period of time (50 years), the main economic indicator to be used is the present value of cash flows. For example, where necessary, cost effectiveness comparisons can be done according to the present value of all costs, including the present value of the investment cash flow plus the present value of the operation and maintenance cash flow.

In comparing irrigation projects, the net present value (NPV), i.e. the present value of benefits minus the present value of costs, is used.

Other widely used economic indicators are employed as and where necessary in the economic analysis: internal rate of return (IRR), benefit-cost ratio (B/C), and benefit/investment ratio (B/I). The latter two indicators are mainly employed for economic ranking of investments under constraints of a limited budget. In the B/C and B/I ratios the "B" (Benefit), "C" (Cost) and "I" (Investment) should be defined in terms of present value. In addition, the benefit (the nominator) should be defined net of the cost or investment (the denominator).

In assessing the benefits and costs of a project or a plan, only the increments should be taken into account, i.e. the additional benefits and costs attributed to the project or plan. For this purpose, the "without plan" scenario should carefully be formulated as the best possible alternative scenario in case the project or plan in question would not be carried out.

All costs and benefits are expressed in constant prices, net of inflation. Where necessary, revaluation of earlier cost estimates is done using price indices.

The discount rate for calculation of NPV was taken as 10%, as commonly used in India in economic evaluation of public sector projects.

# 7. Crop Budgets

## 7.1. Selected Crops

Crop budgets per hectare were prepared by the Consultants for assessing irrigation benefits which can be expected under present as well as future water supply conditions, and under different agroclimatic conditions. Crop budgets were prepared for selected crops considered to be representative for the purpose of evaluating irrigation benefits.

To prepare the crop budgets for application in the economic analysis, for each of the 10 agroclimatic zones (ACZ) covering Rajasthan a list of the main crops was prepared.

For the selected crops in each ACZ a cost of cultivation calculation was prepared as given in Table A3.1 to A3.20 in order to a asses the net income per hectare. Moreover, an agroclimatic zone-wise crop productivity projections were used in the calculations of the net income per hectare for the various development stages (2010, 2020, 2040, 2060).

## 7.2. Considerations in Selecting Crops for Budgeting

- Predominant crops based on existing area, production and productivity were selected.
- Crops were identified on the basis of agroclimatic suitability.
- Crops which give high net returns were preferred.
- Crops which give high net return per unit volume of water were preferred.
- Preference was given to those crops which are responsive to irrigation.
- Crops like Kharif pulses, which do not have a conspicuous response to irrigation, were excluded.
- Certain location-specific suitable and predominant high value crops like cumin, groundnuts, soybean, coriander, etc. were included in view of their high value and future potential.
- High and assured productivity of groundnuts can be obtained by a pre-sowing and a supplementary irrigation in September (same for Bajra, in case of an early withdrawal of the Monsoon). The extent of increased yield can be 30 - 50%. This factor is not being given due consideration, and farmers tend to use irrigation water mostly for Rabi crops.
- Groundnuts require a lot of irrigation water where the rainfall is low and the sandy soil has a very low water holding capacity. Sprinkler irrigation can be a solution in such areas.

## 7.3. Cost Items

The following cost items were explicitly included in the crop budgets:

- seeds
- fertilisers
- weed control materials
- pest control materials
- plant protection chemicals
- human labour (owned and hired)
- machine power
- transportation
- land revenue.

The cost of water was not included in the crop budgets, as this cost varies according to the source of water, and is calculated specifically as part of the engineering and economic analysis of irrigation projects.

Only direct costs were taken into account in the crop budgets, as only these costs are affected by the cropping patterns derived from irrigation water supply conditions, which is the subject of the analysis.

## 7.4. Considerations in Crop Budgeting

The following considerations were taken into account in preparing the financial crop budgets:

- Under irrigated conditions in future, returns can reasonably be expected to be commensurate with investments in various production inputs.
- Future shift from the present use of local seeds to HYVs (high yield varieties) is envisaged in cereals, pulses and oil seeds, with improvement in cultivation practices, improved technology and management.
- Under future conditions, increased use of chemical fertilisers is envisaged, in line with recommended practices and improved technology, and assuming optimal availability of other inputs.
- Presently, agriculture is highly labour-intensive. There are, however, marked peaks and slacks in demand for labour in agriculture. Greater use of other agricultural inputs will further increase the demand for labour. Since there is already unemployment and under-employment of the agricultural labour force, any increase in demand for labour due to the implementation of agriculture and water resources development projects is not likely to pose any serious problem.
- At present, the use of animal power is minimal, and depends upon the agricultural practices being followed and the types of crop grown. With the advent of modern technology, coupled with mechanised agricultural, the use of animal power is likely to continue to decline, in spite of the fact that there are still certain operations, like sowing of cotton etc., which are being done with the help of animal power.
- Presently, the use of machine power is at a low level, and is going to increase in future.

## 7.5. Unit Prices

The entire analysis was done in constant prices in terms of 2010 Rupees. The crop budgets were calculated at the level of the farm, i.e. in terms of farm-gate prices. These values were then fed into the CMLP for the purpose of calculating the optimal net benefits derived from the irrigation project.

Table A3.1 Cost of cultivation for major Rabi crops under ACZ Ia

| Items | | Wheat | | | Mustard | | | Cumin | | | Isabgol | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty /No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | | | | |
| 1.1 | Seed | 120 kg/ha | 18 /kg | 2,160 | 5 kg/ha | 25 /kg | 125 | 15 kg/ha | 200 /kg | 3,000 | 5 kg/ha | 50 /kg | 250 |
| 1.2 | Dap | 50 kg/ha | 11 /kg | 550 | 50 kg/ha | 11 /kg | 550 | - | - | - | - | - | - |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | 100 kg/ha | 6 /kg | 600 | 80 kg/ha | 6 /kg | 480 | 80 kg/ha | 6 /kg | 480 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | 150 kg/ha | 4 /kg | 600 | 150 kg/ha | 4 /kg | 600 |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect - Pest Control Materials | - | - | - | - | - | 1,050 | - | - | 1,400 | - | - | 350 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation - Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation - Electric Pump | 8 No./ha | 650 /No. | 5,200 | 4 No./ha | 650 /No. | 2,600 | 4 No./ha | 650 /No. | 2,600 | 4 No./ha | 650 /No. | 2,600 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | - | - | - | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 15 lb/ha | 100 /lb | 1,500 | 15 lb/ha | 100 /lb | 1,500 |
| 1.15 | Labour - Irrigation | 16 lb/ha | 100 /lb | 1,600 | 8 lb/ha | 100 /lb | 800 | 12 lb/ha | 100 /lb | 1,200 | 12 lb/ha | 100 /lb | 1,200 |
| 1.16 | Labour - Harvesting | 24 lb/ha | 100 /lb | 2,400 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 12 lb/ha | 100 /lb | 1,200 | 4 lb/ha | 100 /lb | 400 | 4 lb/ha | 100 /lb | 400 | 4 lb/ha | 100 /lb | 400 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 28 ql/ha | 30 /ql | 840 | 13 ql/ha | 30 /ql | 390 | 4 ql/ha | 30 /ql | 120 | 10 ql/ha | 30 /ql | 300 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 18,850 | | | 11,515 | | | 15,600 | | | 11,980 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.2 Cost of cultivation for major Kharif crops under ACZ Ia

| Items | | Bajra | | | Guar | | | Moth | | | Castor | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 5 kg/ha | 50 /kg | 250 | 20 kg/ha | 25 /kg | 500 | 15 kg/ha | 50 /kg | 750 | 15 kg/ha | 30 /kg | 450 |
| 1.2 | Dap | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.3 | Urea | - | - | - | - | - | - | - | - | - | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | | - | - | - | - | - | - | 200 kg/ha | 4 /kg | 800 |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | - | - | - | 350 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | 3 No./ha | 650 /No. | 1,950 |
| 1.11 | Cultivator - Disc Harrowing | 1 op/ha | 550 /op | 550 | 1 op/ha | 550 /op | 550 | 1 op/ha | 550 /op | 550 | 1 op/ha | 550 /op | 550 |
| 1.12 | Planking | - | - | - | - | - | - | - | - | - | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 |
| 1.14 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 |
| 1.15 | Labour - Irrigation | - | - | - | - | - | - | - | - | - | 6 lb/ha | 100 /lb | 600 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 20 lb/ha | 100 /lb | 2,000 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 4 lb/ha | 100 /lb | 400 | 4 lb/ha | 100 /lb | 400 | 10 lb/ha | 100 /lb | 1,000 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 8 ql/ha | 30 /ql | 240 | 4 ql/ha | 30 /ql | 120 | 2 ql/ha | 30 /ql | 60 | 15 ql/ha | 30 /ql | 450 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 5,040 | | | 4,770 | | | 4,960 | | | 10,650 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.3 Cost of cultivation for major Rabi crops under ACZ Ib

| Items | | Wheat | | | Barely | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | | | | |
| 1.1 | Seed | 125 kg/ha | 18 /kg | 2,250 | 100 kg/ha | 15 /kg | 1,500 | 65 kg/ha | 25 /kg | 1,625 | 4 kg/ha | 30 /kg | 120 |
| 1.2 | Dap | 100 kg/ha | 11 /kg | 1,100 | 75 kg/ha | 11 /kg | 825 | 50 kg/ha | 11 /kg | 550 | 50 kg/ha | 11 /kg | 550 |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | 150 kg/ha | 6 /kg | 900 | - | - | - | 150 kg/ha | 6 /kg | 900 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | - | - | - | 1,000 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | 200 | - | - | 200 |
| 1.8 | Irrigation - Canal | 1 No./ha | 150 /No. | 150 | 1 No./ha | 80 /No. | 80 | 1 No./ha | 110 /No. | 110 | 1 No./ha | 115 /No. | 115 |
| 1.9 | Irrigation -Diesel Pump | 2 No./ha | 1,400 /No. | 2,800 | - | - | - | - | - | - | 1 No./ha | 1,400 /No. | 1,400 |
| 1.1 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 1 op/ha | 550 /op | 550 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 2 op/ha | 350 /op | 700 | 2 op/ha | 350 /op | 700 | 2 op/ha | 350 /op | 700 | 2 op/ha | 350 /op | 700 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 |
| 1.15 | Labour - Irrigation | 6 lb/ha | 100 /lb | 600 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 4 lb/ha | 100 /lb | 400 |
| 1.16 | Labour - Harvesting | 24 lb/ha | 100 /lb | 2,400 | 24 lb/ha | 100 /lb | 2,400 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 12 lb/ha | 100 /lb | 1,200 | 12 lb/ha | 100 /lb | 1,200 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 30 ql/ha | 30 /ql | 900 | 18 ql/ha | 30 /ql | 540 | 8 ql/ha | 30 /ql | 240 | 14 ql/ha | 30 /ql | 420 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 16,700 | | | 11,745 | | | 9,475 | | | 11,605 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.4 Cost of cultivation for major Kharif crops under ACZ Ib

| Items | | Cotton (Desi) | | | Cotton (American) | | | Guar | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | |
| 1.1 | Seed | 14 kg/ha | 50 /kg | 700 | 16 kg/ha | 60 /kg | 960 | 20 kg/ha | 25 /kg | 500 |
| 1.2 | Dap | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | - | - | - |
| 1.3 | Urea | 300 kg/ha | 6 /kg | 1,800 | 300 kg/ha | 6 /kg | 1,800 | - | - | - |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed Control Materials | - | - | - | - | - | - | - | - | - |
| 1.6 | Inset - Pest Control Materials | - | - | 240 | - | - | 240 | - | - | - |
| 1.7 | Disease Control Materials | - | - | 210 | - | - | 210 | - | - | - |
| 1.8 | Irrigation - canal | 6 No./ha | 72 /No. | 432 | 7 No./ha | 72 /No. | 504 | - | - | - |
| 1.9 | Diesel - Pump | 1 No./ha | 1,400 /No. | 1,400 | 1 No./ha | 1,400 /No. | 1,400 | - | - | - |
| 1.10 | Electric - Pump | - | - | - | - | - | - | - | - | - |
| 1.11 | Cultivator- Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 1 op/ha | 550 /op | 550 |
| 1.12 | Planking & Bunding | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 20 lb/ha | 100 /lb | 2,000 | 20 lb/ha | 100 /lb | 2,000 | 20 lb/ha | 100 /lb | 2,000 |
| 1.15 | Labour - Irrigation | 14 lb/ha | 100 /lb | 1,400 | 16 lb/ha | 100 /lb | 1,600 | - | - | - |
| 1.16 | Labour - Picking / Harvesting | 30 lb/ha | 100 /lb | 3,000 | 30 lb/ha | 100 /lb | 3,000 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 15 lb/ha | 100 /lb | 1,500 | 15 lb/ha | 100 /lb | 1,500 | 4 lb/ha | 100 /lb | 400 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 16 ql/ha | 30 /ql | 480 | 19 ql/ha | 30 /ql | 570 | 5 ql/ha | 30 /ql | 150 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 17,012 | | | 17,634 | | | 6,850 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.5 Cost of cultivation for major Rabi crops under ACZ Ic

| Items | | Wheat | | | Barely | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | | | | |
| 1.1 | Seed | 125 kg/ha | 18 /kg | 2,250 | 100 kg/ha | 15 /kg | 1,500 | 70 kg/ha | 25 /kg | 1,750 | 5 kg/ha | 25 /kg | 125 |
| 1.2 | Dap | 100 kg/ha | 11 /kg | 1,100 | 75 kg/ha | 11 /kg | 825 | 50 kg/ha | 11 /kg | 550 | 50 kg/ha | 11 /kg | 550 |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | 150 kg/ha | 6 /kg | 900 | - | - | - | 125 kg/ha | 6 /kg | 750 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Inset - Pest Control Materials | - | - | - | - | - | - | - | - | - | - | - | 1,000 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | 200 | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation - Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation - Electric Pump | 8 No./ha | 650 /No. | 5,200 | 3 No./ha | 650 /No. | 1,950 | 1 No./ha | 650 /No. | 650 | 3 No./ha | 650 /No. | 1,950 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking & Bunding | 2 op/ha | 350 /op | 700 | 2 op/ha | 350 /op | 700 | 2 op/ha | 350 /op | 700 | 2 op/ha | 350 /op | 700 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 |
| 1.15 | Labour - Irrigation | 16 lb/ha | 100 /lb | 1,600 | 6 lb/ha | 100 /lb | 600 | 2 lb/ha | 100 /lb | 200 | 6 lb/ha | 100 /lb | 600 |
| 1.16 | Labour - Harvesting | 24 lb/ha | 100 /lb | 2,400 | 24 lb/ha | 100 /lb | 2,400 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 12 lb/ha | 100 /lb | 1,200 | 12 lb/ha | 100 /lb | 1,200 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 35 ql/ha | 30 /ql | 1,050 | 18 ql/ha | 30 /ql | 540 | 9 ql/ha | 30 /ql | 270 | 13 ql/ha | 30 /ql | 390 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 20,100 | | | 14,015 | | | 10,720 | | | 11,865 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.6 Cost of cultivation for major Kharif crops under ACZ Ic

| Items | | Bajra | | | Guar | | | Groundnut | | | Moth | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 5 kg/ha | 75 /kg | 375 | 25 kg/ha | 30 /kg | 750 | 100 kg/ha | 50 /kg | 5,000 | 15 kg/ha | 50 /kg | 750 |
| 1.2 | Dap | - | - | - | - | - | - | 150 kg/ha | 11 /kg | 1,650 | - | - | - |
| 1.3 | Urea | - | - | - | - | - | - | 100 kg/ha | 6 /kg | 600 | - | - | - |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | 20 kg/ha | 50 /kg | 1,000 | - | - | - |
| 1.5 | Weed Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect - Pest Control Materials | - | - | - | - | - | - | - | - | 1,500 | - | - | - |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | 250 | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation - Diesel Pump | - | - | - | - | - | - | 1 No./ha | 1,400 /No. | 1,400 | - | - | - |
| 1.10 | Irrigation - Electric Pump | - | - | - | - | - | - | 5 No./ha | 650 /No. | 3,250 | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 1 op/ha | 550 /op | 550 | 1 op/ha | 550 /op | 550 | 2 op/ha | 550 /op | 1,100 | 1 op/ha | 550 /op | 550 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 |
| 1.14 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 20 lb/ha | 100 /lb | 2,000 | 5 lb/ha | 100 /lb | 500 |
| 1.15 | Labour - Irrigation | - | - | - | - | - | - | 20 lb/ha | 100 /lb | 2,000 | - | - | - |
| 1.16 | Labour : Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour : Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour : Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 7 ql/ha | 30 /ql | 210 | 4 ql/ha | 30 /ql | 120 | 20 ql/ha | 30 /ql | 600 | 2 ql/ha | 30 /ql | 60 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 5,435 | | | 5,720 | | | 24,750 | | | 5,660 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.7 Cost of cultivation for major Rabi crops under ACZ IIa

| Items | | Wheat | | | Barely | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | | | | |
| 1.1 | Seed | 120 kg/ha | 18 /kg | 2,160 | 100 kg/ha | 15 /kg | 1,500 | 70 kg/ha | 25 /kg | 1,750 | 5 kg/ha | 30 /kg | 150 |
| 1.2 | Dap | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | 100 kg/ha | 6 /kg | 600 | - | - | - | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | 250 | - | - | 1,000 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | - | - | - | 250 |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.1 | Irrigation -Electric Pump | 8 No./ha | 650 /No. | 5,200 | 5 No./ha | 650 /No. | 3,250 | 1 No./ha | 650 /No. | 650 | 2 No./ha | 650 /No. | 1,300 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 1 op/ha | 550 /op | 550 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 2 op/ha | 300 /op | 600 | 2 op/ha | 300 /op | 600 | 1 op/ha | 300 /op | 300 | 2 op/ha | 300 /op | 600 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 |
| 1.15 | Labour - Irrigation | 16 lb/ha | 100 /lb | 1,600 | 10 lb/ha | 100 /lb | 1,000 | 2 lb/ha | 100 /lb | 200 | 4 lb/ha | 100 /lb | 400 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 35 ql/ha | 30 /ql | 1,050 | 22 ql/ha | 30 /ql | 660 | 8 ql/ha | 30 /ql | 240 | 13 ql/ha | 30 /ql | 390 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 18,710 | | | 14,510 | | | 9,740 | | | 11,590 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.8 Cost of cultivation for major Kharif crops under ACZ IIa

| Items | | Bajra | | | Jowar | | | Groundnut | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | |
| 1.1 | Seed | 5 kg/ha | 75 /kg | 375 | 15 kg/ha | 50 /kg | 750 | 100 kg/ha | 50 /kg | 5,000 |
| 1.2 | Dap | - | - | - | - | - | - | 150 kg/ha | 11 /kg | 1,650 |
| 1.3 | Urea | 60 kg/ha | 6 /kg | 360 | - | - | - | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | 1,400 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | 250 |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | 6 No./ha | 600 /No. | 3,600 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 |
| 1.13 | Sowing | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 |
| 1.14 | Labour - Weeding, Hoeing | 6 lb/ha | 100 /lb | 600 | 6 lb/ha | 100 /lb | 600 | 20 lb/ha | 100 /lb | 2,000 |
| 1.15 | Labour - Irrigation | - | - | - | - | - | - | 12 lb/ha | 100 /lb | 1,200 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 20 lb/ha | 100 /lb | 2,000 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 10 lb/ha | 100 /lb | 1,000 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 10 ql/ha | 30 /ql | 300 | 10 ql/ha | 30 /ql | 300 | 16 ql/ha | 30 /ql | 480 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 6,585 | | | 6,600 | | | 21,730 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.9 Cost of cultivation for major Rabi crops under ACZ IIb

| Items | | Wheat | | | Barely | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 125 kg/ha | 18 /kg | 2,250 | 125 kg/ha | 15 /kg | 1,875 | 75 kg/ha | 25 /kg | 1,875 | 5 kg/ha | 25 /kg | 125 |
| 1.2 | Dap | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 |
| 1.3 | Urea | 150 kg/ha | 6 /kg | 900 | 100 kg/ha | 6 /kg | 600 | - | - | - | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | 250 | - | - | 800 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | 1No./ha | 80 /No. | 80 | - | - | - | 1 No./ha | 115 /No. | 115 |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | 8 No./ha | 650 /No. | 5,200 | - | - | - | 1 No./ha | 650 /No. | 650 | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 |
| 1.15 | Labour - Irrigation | 16 lb/ha | 100 /lb | 1,600 | 1 lb/ha | 100 /lb | 100 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 28 ql/ha | 30 /ql | 840 | 2 ql/ha | 30 /ql | 750 | 10 ql/ha | 30 /ql | 300 | 12 ql/ha | 30 /ql | 360 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 17,990 | | | 10,605 | | | 10,475 | | | 9,400 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.10 Cost of cultivation for major Kharif crops under ACZ IIb

| Items | | Bajra | | | Jowar | | | Groundnut | | | Maize | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 5 kg/ha | 75 /kg | 375 | 15 kg/ha | 50 /kg | 750 | 100 kg/ha | 50 /kg | 5,000 | 25 kg/ha | 25 /kg | 625 |
| 1.2 | Dap | - | - | - | - | - | - | 150 kg/ha | 11 /kg | 1,650 | - | - | - |
| 1.3 | Urea | 60 kg/ha | 6 /kg | 360 | - | - | - | 100 kg/ha | 6 /kg | 600 | 60 kg/ha | 6 /kg | 360 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | 1 No./ha | 115 /No. | 115 | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | 2 No./ha | 650 /No. | 1,300 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 |
| 1.14 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 20 lb/ha | 100 /lb | 2,000 | 5 lb/ha | 100 /lb | 500 |
| 1.15 | Labour - Irrigation | - | - | - | - | - | - | 2 lb/ha | 100 /lb | 200 | 4 lb/ha | 100 /lb | 400 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 14 ql/ha | 30 /ql | 420 | 12 ql/ha | 30 /ql | 360 | 14 ql/ha | 30 /ql | 420 | 14 ql/ha | 30 /ql | 420 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 6,555 | | | 6,510 | | | 15,485 | | | 8,505 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.11 Cost of cultivation for major Rabi crops under ACZ IIIa

| Items | | Wheat | | | Barely | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 120 kg/ha | 18 /kg | 2,160 | 100 kg/ha | 15 /kg | 1,500 | 75 kg/ha | 25 /kg | 1,875 | 4 kg/ha | 30 /kg | 120 |
| 1.2 | Dap | 50 kg/ha | 11 /kg | 550 | 75 kg/ha | 11 /kg | 825 | 50 kg/ha | 11 /kg | 550 | 50 kg/ha | 11 /kg | 550 |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | 125 kg/ha | 6 /kg | 750 | - | - | - | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | - | - | - | 350 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | 6 No./ha | 550 /No. | 3,300 | 4 No./ha | 550 /No. | 2,200 | 2 No./ha | 550 /No. | 1,100 | 4 No./ha | 550 /No. | 2,200 |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 1 op/ha | 550 /op | 550 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 6 lb/ha | 100 /lb | 600 | 6 lb/ha | 100 /lb | 600 | 6 lb/ha | 100 /lb | 600 | 6 lb/ha | 100 /lb | 600 |
| 1.15 | Labour - Irrigation | 16 lb/ha | 100 /lb | 1,600 | 10 lb/ha | 100 /lb | 1,000 | 2 lb/ha | 100 /lb | 200 | 4 lb/ha | 100 /lb | 400 |
| 1.16 | Labour - Harvesting | 24 lb/ha | 100 /lb | 2,400 | 20 lb/ha | 100 /lb | 2,000 | 20 lb/ha | 100 /lb | 2,000 | 15 lb/ha | 100 /lb | 1,500 |
| 1.17 | Labour - Threshing | 15 lb/ha | 100 /lb | 1,500 | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 38 ql/ha | 30 /ql | 1,140 | 36 ql/ha | 30 /ql | 1,080 | 12 ql/ha | 30 /ql | 360 | 16 ql/ha | 30 /ql | 480 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 17,150 | | | 13,655 | | | 9,835 | | | 10,300 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.12 Cost of cultivation for major Kharif crops under ACZ IIIa

| Items | | Bajra | | | Jowar | | | Groundnut | | | Maize | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 5 kg/ha | 75 /kg | 375 | 10 kg/ha | 50 /kg | 500 | 100 kg/ha | 50 /kg | 5,000 | 25 kg/ha | 30 /kg | 750 |
| 1.2 | Dap | - | - | - | - | - | - | 150 kg/ha | 11 /kg | 1,650 | 100 kg/ha | 11 /kg | 1,100 |
| 1.3 | Urea | 80 kg/ha | 6 /kg | 480 | 65 kg/ha | 6 /kg | 390 | 100 kg/ha | 6 /kg | 600 | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | 1,600 | - | - | - |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | 300 | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | 1 No./ha | 450 /No. | 450 |
| 1.11 | Cultivator - Disc Harrowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 6 lb/ha | 100 /lb | 600 | 6 lb/ha | 100 /lb | 600 | 20 lb/ha | 100 /lb | 2,000 | 6 lb/ha | 100 /lb | 600 |
| 1.15 | Labour - Irrigation | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 12 ql/ha | 30 /ql | 360 | 14 ql/ha | 30 /ql | 420 | 18 ql/ha | 30 /ql | 540 | 18 ql/ha | 30 /ql | 540 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 6,415 | | | 6,510 | | | 16,890 | | | 8,640 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.13 Cost of cultivation for major Rabi crops under ACZ IIIb

| Items | | Wheat | | | Barely | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 120 kg/ha | 18 /kg | 2,160 | 100 kg/ha | 15 /kg | 1,500 | 80 kg/ha | 25 /kg | 2,000 | 4 kg/ha | 29 /kg | 116 |
| 1.2 | DAP | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | 100 kg/ha | 6 /kg | 600 | - | - | - | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | 750 | - | - | 750 |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | 5 No./ha | 625 /No. | 3,125 | 4 No./ha | 625 /No. | 2,500 | 1 No./ha | 625 /No. | 625 | 2 No./ha | 625 /No. | 1,250 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 |
| 1.15 | Labour - Irrigation | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 | 2 lb/ha | 100 /lb | 200 | 4 lb/ha | 100 /lb | 400 |
| 1.16 | Labour - Harvesting | 20 lb/ha | 100 /lb | 2,000 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 10 lb/ha | 100 /lb | 1,000 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 40 ql/ha | 30 /ql | 1,200 | 36 ql/ha | 30 /ql | 1,080 | 4 ql/ha | 30 /ql | 120 | 16 ql/ha | 30 /ql | 480 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 15,985 | | | 13,780 | | | 10,395 | | | 10,296 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.14 Cost of cultivation for major Kharif crops under ACZ IIIb

| Items | | Bajra | | | Cotton (AM) | | | Jowar | | | Maize | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) | Qty/ No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 4 kg/ha | 75 /kg | 300 | 16 kg/ha | 150 /kg | 2,400 | 10 kg/ha | 55 /kg | 550 | 25 kg/ha | 60 /kg | 1,500 |
| 1.2 | Dap | - | - | - | 100 kg/ha | 11 /kg | 1,100 | - | - | - | - | - | - |
| 1.3 | Urea | 60 kg/ha | 6 /kg | 360 | 160 kg/ha | 6 /kg | 960 | 50 kg/ha | 6 /kg | 300 | 60 kg/ha | 6 /kg | 360 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | 1,500 | - | - | - | - | - | - |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | 4 No./ha | 1,400 /No. | 5,600 | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 4 op/ha | 550 /op | 2,200 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 300 /op | 300 | 2 op/ha | 300 /op | 600 | 1 op/ha | 300 /op | 300 | 1 op/ha | 300 /op | 300 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 10 lb/ha | 100 /lb | 1,000 | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 |
| 1.15 | Labour - Irrigation | - | - | - | 8 lb/ha | 100 /lb | 800 | - | - | - | - | - | - |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 15 ql/ha | 30 /ql | 450 | 16 ql/ha | 30 /ql | 480 | 18 ql/ha | 30 /ql | 540 | 22 ql/ha | 30 /ql | 660 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 6,710 | | | 20,940 | | | 6,990 | | | 8,120 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.15 Cost of cultivation for major Rabi crops under ACZ IVa

| Items | | Wheat | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | |
| 1.1 | Seed | 150 kg/ha | 18 /kg | 2,700 | 70 kg/ha | 25 /kg | 1,750 | 6 kg/ha | 29 /kg | 174 |
| 1.2 | Dap | 100 kg/ha | 11 /kg | 1,100 | 50 kg/ha | 11 /kg | 550 | 50 kg/ha | 11 /kg | 550 |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | - | - | - | 100 kg/ha | 6 /kg | 600 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | 750 | - | - | 750 |
| 1.7 | Disease Control Materials | - | - | - | - | - | 250 | - | - | 250 |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | 6 No./ha | 650 /No. | 3,900 | 2 No./ha | 650 /No. | 1,300 | 3 No./ha | 650 /No. | 1,950 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 | 2 op/ha | 550 /op | 1,100 |
| 1.12 | Planking | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 |
| 1.15 | Labour - Irrigation | 12 lb/ha | 100 /lb | 1,200 | 4 lb/ha | 100 /lb | 400 | 6 lb/ha | 100 /lb | 600 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 35 ql/ha | 30 /ql | 1,050 | 10 ql/ha | 30 /ql | 300 | 12 ql/ha | 30 /ql | 360 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 16,800 | | | 10,950 | | | 10,884 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.16 Cost of cultivation for major Kharif crops under ACZ IVa

| Items | | Cotton | | | Jowar | | | Maize | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | |
| 1.1 | Seed | 20 kg/ha | 40 /kg | 800 | 15 kg/ha | 55 /kg | 825 | 25 kg/ha | 45 /kg | 1,125 |
| 1.2 | Dap | 120 kg/ha | 11 /kg | 1,320 | - | - | - | 100 kg/ha | 11 /kg | 1,100 |
| 1.3 | Urea | 250 kg/ha | 6 /kg | 1,500 | - | - | - | 150 kg/ha | 6 /kg | 900 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | 750 | - | - | - | - | - | 250 |
| 1.7 | Disease Control Materials | - | - | 500 | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Electric Pump | 6 No./ha | 450 /No. | 2,700 | - | - | - | 1 No./ha | 450 /No. | 450 |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 |
| 1.12 | Planking | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 16 lb/ha | 100 /lb | 1,600 | 6 lb/ha | 100 /lb | 600 | 6 lb/ha | 100 /lb | 600 |
| 1.15 | Labour - Irrigation | 12 lb/ha | 100 /lb | 1,200 | - | - | - | 2 lb/ha | 100 /lb | 200 |
| 1.16 | Labour - Harvesting | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 15 ql/ha | 30 /ql | 450 | 18 ql/ha | 30 /ql | 540 | 25 ql/ha | 30 /ql | 750 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 16,670 | | | 7,215 | | | 10,625 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.17 Cost of cultivation for major Rabi crops under ACZ IVb

| Items | | Wheat | | | Maize | | | Gram | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | |
| 1.1 | Seed | 100 kg/ha | 18 /kg | 1,800 | 25 kg/ha | 45 /kg | 1,125 | 70 kg/ha | 25 /kg | 1,750 |
| 1.2 | Dap | 100 kg/ha | 11 /kg | 1,100 | 100 kg/ha | 11 /kg | 1,100 | 50 kg/ha | 11 /kg | 550 |
| 1.3 | Urea | 200 kg/ha | 6 /kg | 1,200 | 150 kg/ha | 6 /kg | 900 | - | - | - |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | - | - | - | 1,000 |
| 1.7 | Disease Control Materials | - | - | - | - | - | - | - | - | 250 |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | 5 No./ha | 1,400 /No. | 7,000 | - | - | - | 1 No./ha | 1,400 /No. | 1,400 |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 |
| 1.12 | Planking | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 | 5 lb/ha | 100 /lb | 500 |
| 1.15 | Labour - Irrigation | 10 lb/ha | 100 /lb | 1,000 | - | - | - | 2 lb/ha | 100 /lb | 200 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 38 ql/ha | 30 /ql | 1,140 | 35 ql/ha | 30 /ql | 1,050 | 10 ql/ha | 30 /ql | 300 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 18,990 | | | 9,925 | | | 11,200 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.18 Cost of cultivation for major Kharif crops under ACZ IVb

| Items | | Soyabean | | | Cotton | | | Rice | | | Maize | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | | | | |
| 1.1 | Seed | 90 kg/ha | 30 /kg | 2,700 | 20 kg/ha | 40 /kg | 800 | 40 kg/ha | 15 /kg | 600 | 25 kg/ha | 45 /kg | 1,125 |
| 1.2 | DAP | 50 kg/ha | 11 /kg | 550 | 100 kg/ha | 11 /kg | 1,100 | - | - | - | 100 kg/ha | 11 /kg | 1,100 |
| 1.3 | Urea | - | - | - | 250 kg/ha | 6 /kg | 1,500 | 150 kg/ha | 6 /kg | 900 | 150 kg/ha | 6 /kg | 900 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | 200 kg/ha | 4 /kg | 800 | - | - | - |
| 1.5 | Weed control Materials | - | - | 350 | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | 1,250 | - | - | - | - | - | 250 |
| 1.7 | Disease Control Materials | - | - | - | - | - | 750 | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | - | - | - | 2 No./ha | 1,400 /No. | 2,800 | 2 No./ha | 1,400 /No. | 2,800 | 1 No./ha | 1,400 /No. | 1,400 |
| 1.10 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 |
| 1.12 | Planking | 1 op/ha | 350 /op | 350 | 1 op/ha | 350 /op | 350 | - | - | - | 1 op/ha | 350 /op | 350 |
| 1.13 | Sowing | 1 op/ha | 600 /op | 600 | 1 op/ha | 600 /op | 600 | 1 op/ha | 800 /op | 800 | 1 op/ha | 600 /op | 600 |
| 1.14 | Labour - Weeding, Hoeing | 6 lb/ha | 100 /lb | 600 | 10 lb/ha | 100 /lb | 1,000 | 16 lb/ha | 100 /lb | 1,600 | 6 lb/ha | 100 /lb | 600 |
| 1.15 | Labour - Irrigation | - | - | - | 4 lb/ha | 100 /lb | 400 | 4 lb/ha | 100 /lb | 400 | 2 lb/ha | 100 /lb | 200 |
| 1.16 | Labour - Harvesting | 16 lb/ha | 100 /lb | 1,600 | 20 lb/ha | 100 /lb | 2,000 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.17 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 10 lb/ha | 100 /lb | 1,000 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 15 ql/ha | 30 /ql | 450 | 18 ql/ha | 30 /ql | 540 | 23 ql/ha | 30 /ql | 690 | 25 ql/ha | 30 /ql | 750 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 9,900 | | | 15,990 | | | 12,890 | | | 11,575 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.19 Cost of cultivation for major Rabi crops under ACZ V

| Items | | Wheat | | | Coriander | | | Gram | | | Mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| 1 | COST | | | | | | | | | | | | |
| 1.1 | Seed | 130 kg/ha | 18 /kg | 2,340 | 30 kg/ha | 50 /kg | 1,500 | 70 kg/ha | 25 /kg | 1,750 | 6 kg/ha | 29 /kg | 174 |
| 1.2 | Dap | 150 kg/ha | 11 /kg | 1,650 | 100 kg/ha | 11 /kg | 1,100 | 50 kg/ha | 11 /kg | 550 | 100 kg/ha | 11 /kg | 1,100 |
| 1.3 | Urea | 250 kg/ha | 6 /kg | 1,500 | 150 kg/ha | 6 /kg | 900 | - | - | - | 200 kg/ha | 6 /kg | 1,200 |
| 1.4 | Other Fertilizers | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.5 | Weed control Materials | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.6 | Insect-Pest control Materials | - | - | - | - | - | 750 | - | - | 750 | - | - | 750 |
| 1.7 | Disease Control Materials | - | - | - | - | - | 250 | - | - | - | - | - | - |
| 1.8 | Irrigation - Canal | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation -Diesel Pump | 5 No./ha | 1,400 /No. | 7,000 | 3 No./ha | 1,400 /No. | 4,200 | 1 No./ha | 1,400 /No. | 1,400 | 2 No./ha | 1,400 /No. | 2,800 |
| 1.1 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - | - | - | - |
| 1.11 | Cultivator - Disc Harrowing | 2 op/ha | 700 /op | 1,400 | 2 op/ha | 700 /op | 1,400 | 2 op/ha | 700 /op | 1,400 | 2 op/ha | 700 /op | 1,400 |
| 1.12 | Planking | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 |
| 1.13 | Sowing | 1 op/ha | 650 /op | 650 | 1 op/ha | 650 /op | 650 | 1 op/ha | 650 /op | 650 | 1 op/ha | 650 /op | 650 |
| 1.14 | Labour - Weeding, Hoeing | 6 lb/ha | 100 /lb | 600 | 15 lb/ha | 100 /lb | 1,500 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.15 | Labour - Irrigation | 10 lb/ha | 100 /lb | 1,000 | 6 lb/ha | 100 /lb | 600 | 2 lb/ha | 100 /lb | 200 | 4 lb/ha | 100 /lb | 400 |
| 1.16 | Labour - Harvesting (On Contract) | 1 lb/ha | 3,750 /lb | 3,750 | 1 lb/ha | 3,000 /lb | 3,000 | 1 lb/ha | 3,000 /lb | 3,000 | 1 lb/ha | 3,500 /lb | 3,500 |
| 1.17 | Labour - Threshing | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 | 16 lb/ha | 100 /lb | 1,600 |
| 1.18 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.19 | Transportation to market | 40 ql/ha | 30 /ql | 1,200 | 15 ql/ha | 30 /ql | 450 | 12 ql/ha | 30 /ql | 360 | 16 ql/ha | 30 /ql | 480 |
| 1.20 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 23,790 | | | 19,000 | | | 12,960 | | | 15,354 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

Table A3.20 Cost of cultivation for major Kharif crops under ACZ V

| Items | | Soybean | | | Rice | | | Maize | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) | Qty/No. | Rate (Rs) | Amount (Rs/ha) |
| **1** | **COST** | | | | | | | | | |
| 1.1 | Seed | 90 kg/ha | 30 /kg | 2,700 | 40 kg/ha | 30 /kg | 1,200 | 20 kg/ha | 35 /kg | 700 |
| 1.2 | Nursery | - | - | - | - | - | 1,000 | - | - | - |
| 1.3 | DAP | - | - | - | - | - | - | - | - | - |
| 1.4 | Urea | - | - | - | 120 kg/ha | 6 /kg | 720 | 100 kg/ha | 6 /kg | 600 |
| 1.5 | Other Fertilizers | - | - | - | - | - | 2,000 | - | - | - |
| 1.6 | Weed control Materials | - | - | - | - | - | - | - | - | - |
| 1.7 | Insect-Pest control Materials | - | - | - | - | - | 2,000 | - | - | 250 |
| 1.8 | Disease Control Materials | - | - | - | - | - | - | - | - | - |
| 1.9 | Irrigation - Canal | - | - | - | - | - | - | - | - | - |
| 1.10 | Irrigation -Diesel Pump | - | - | - | 4 No./ha | 1,400 /No. | 5,600 | - | - | - |
| 1.11 | Irrigation -Electric Pump | - | - | - | - | - | - | - | - | - |
| 1.12 | Cultivator - Disc Harrowing | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 | 2 op/ha | 600 /op | 1,200 |
| 1.13 | Planking | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 | 1 op/ha | 400 /op | 400 |
| 1.14 | Sowing | 1 op/ha | 650 /op | 650 | 1 op/ha | 4,000 /op | 4,000 | 1 op/ha | 650 /op | 650 |
| 1.15 | Labour - Weeding, Hoeing | 5 lb/ha | 100 /lb | 500 | 15 lb/ha | 100 /lb | 1,500 | 5 lb/ha | 100 /lb | 500 |
| 1.16 | Labour - Irrigation | - | - | - | 8 lb/ha | 100 /lb | 800 | - | - | - |
| 1.17 | Labour - Harvesting (on contract) | 1 lb/ha | 3,500 /lb | 3,500 | 1 lb/ha | 5,500 /lb | 5,500 | 1 lb/ha | 3,500 /lb | 3,500 |
| 1.18 | Labour - Threshing | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 | 8 lb/ha | 100 /lb | 800 |
| 1.19 | Labour - Miscellaneous | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 | 2 lb/ha | 100 /lb | 200 |
| 1.20 | Transportation to market | 15 ql/ha | 30 /ql | 450 | 35 ql/ha | 30 /ql | 1,050 | 25 ql/ha | 30 /ql | 750 |
| 1.21 | Land Revenue | - | - | 500 | - | - | 500 | - | - | 500 |
| | Total Cost | | | 10,900 | | | 28,470 | | | 10,050 |

Source: Consultant's Field Survey

Ls: Lumpsum; Qty: Quantity; No.: Number; op: Operation; lb: Labour; Rs: Rupees; ha: Hectare; kg: Kilogram; ql: Quintal

# Annex 4

# Project Planning Sheets

**(in soft copy)**

**One Sample for Arwar Irrigation Project (in hard copy)**

# Annex 4

# Project Planning Sheets - Sample

**Irrigation Project Planning Worksheet**

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **ARWAR Irrigation Project**

**I. Water Resources Information System (WRIS) Data**

| | | | | |
|---|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | | B |
| Status: | Existing | Reference Document: | | |
| River Basin: | Banas | Linked to Project(s): | | |
| District | Bhilwara | | Name(s): | |
| Groundwater Potential Zone (PZ) | shahpura | | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 580 | Conditional on Project: | | |
| Present Live Storage, $Mm^3$ | 43.99 | | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | | Name: | |

**II. Priority Water Demands** (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.44 | 0.89 | 0.89 | 1.10 | 1.10 | 1.23 | 1.23 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.39 | 0.41 | 0.41 | 0.44 | 0.44 | 0.47 | 0.47 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 7,394 | 7,394 | 7,394 | 7,394 | 7,394 | 7,394 | 7,394 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 16.98 | | | | | | |
| 2010 Irrigated Area | | ha | 3905 | | | | | | |

**III. Water Sources**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: Mean | | $Mm^3/yr$ | 27.89 | 27.89 | 27.89 | 27.89 | 27.89 | 27.89 | 27.89 |
| | Dependability 90% | $Mm^3/yr$ | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| | Dependability 75% | $Mm^3/yr$ | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| | Dependability 50% | $Mm^3/yr$ | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| | Dependability 25% | $Mm^3/yr$ | 45.30 | 45.30 | 45.30 | 45.30 | 45.30 | 45.30 | 45.30 |
| | Weighted Mean | $Mm^3/yr$ | 18.54 | 18.54 | 18.54 | 18.54 | 18.54 | 18.54 | 18.54 |
| Losses from Reservoir Annual | | % | 14.85 | | | | | | |
| | During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation | Per $km^2$ | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.08 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.76 | 0.76 | 2.28 | 2.28 | 3.80 | 3.80 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 43.99 | 43.23 | 43.23 | 41.71 | 41.71 | 40.19 | 40.19 |
| Import: Mean | | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | | $Mm^3/yr$ | 16.79 | 16.56 | 16.56 | 16.09 | 16.09 | 15.62 | 15.62 |
| | Dependability 90% | $Mm^3/yr$ | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| | Dependability 75% | $Mm^3/yr$ | 4.64 | 4.64 | 4.64 | 4.64 | 4.64 | 4.64 | 4.64 |
| | Dependability 50% | $Mm^3/yr$ | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 |
| | Dependability 25% | $Mm^3/yr$ | 40.80 | 40.09 | 40.09 | 38.68 | 38.68 | 37.27 | 37.27 |
| On-Farm Irrigation Efficiency | | % | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 |
| Off-Farm Irrigation Efficiency | | % | 39.60 | 72.00 | 39.60 | 72.00 | 39.60 | 72.00 | 39.60 |
| Present Overall Irrigation Efficiency | | % | 28.03 | | | | | | |
| Gross SW on Farm:Weighted Mean | | $Mm^3/yr$ | 6.65 | 11.92 | 6.56 | 11.58 | 6.37 | 11.25 | 6.19 |
| | Dependability 90% | $Mm^3/yr$ | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 |
| | Dependability 75% | $Mm^3/yr$ | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 |
| | Dependability 50% | $Mm^3/yr$ | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 |
| | Dependability 25% | $Mm^3/yr$ | 16.16 | 28.87 | 15.88 | 27.85 | 15.32 | 26.84 | 14.76 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | | mm/yr | 90 | 161 | 89 | 157 | 86 | 152 | 84 |
| | Dependability 90% | mm/yr | 3 | 6 | 3 | 6 | 3 | 6 | 3 |
| | Dependability 75% | mm/yr | 25 | 45 | 25 | 45 | 25 | 45 | 25 |
| | Dependability 50% | mm/yr | 45 | 81 | 45 | 81 | 45 | 81 | 45 |
| | Dependability 25% | mm/yr | 218 | 390 | 215 | 377 | 207 | 363 | 200 |
| Peak Month Supply Capacity | | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | | $Mm^3/mo$ | 10.20 | 10.02 | 10.02 | 9.67 | 9.67 | 9.32 | 9.32 |
| Pump | Discharge(max) | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| | Head | m | | | 0.00 | | 0.00 | | 0.00 |
| | Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main | Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | | $Mm^3/yr$ | 0.44 | 0.69 | 0.69 | 1.20 | 1.20 | 1.70 | 1.70 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 1.31 | 2.07 | 2.07 | 3.59 | 3.59 | 5.11 | 5.11 |
| Possible Domestic+Livestock Wtd Mean | | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| b. Groundwater | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | 2020 | | 2040 | | 2060 | |
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Normalised Natural Replenishment | | $Mm^3/yr$ | 2.43 | 2.43 | 2.43 | 2.43 | 2.43 | 2.43 | 2.43 |
| Mining Potential | | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge | Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | | % | | 25.00 | | 25.00 | | 25.00 | |
| | Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| | Combined, at present | % | 50.38 | | 50.38 | | 50.38 | | 50.38 |
| | Weighted Mean | $Mm^3/yr$ | 8.46 | 5.96 | 8.34 | 5.79 | 8.11 | 5.62 | 7.87 |
| | Dependability 90% | $Mm^3/yr$ | 0.33 | 0.23 | 0.33 | 0.23 | 0.33 | 0.23 | 0.33 |
| | Dependability 75% | $Mm^3/yr$ | 2.34 | 1.67 | 2.34 | 1.67 | 2.34 | 1.67 | 2.34 |
| | Dependability 50% | $Mm^3/yr$ | 4.20 | 3.00 | 4.20 | 3.00 | 4.20 | 3.00 | 4.20 |
| | Dependability 25% | $Mm^3/yr$ | 20.55 | 14.43 | 20.20 | 13.93 | 19.49 | 13.42 | 18.78 |
| Return Flows - GW Irrigation: On Farm | | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| | Weighted Mean | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| | Dependability 90% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| | Dependability 75% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| | Dependability 50% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| | Dependability 25% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| Total Irrigation Return Flows: Wtd.Mean | | $Mm^3/yr$ | 8.94 | 6.19 | 8.68 | 5.97 | 8.37 | 5.77 | 8.09 |
| | Dependability 90% | $Mm^3/yr$ | 0.81 | 0.46 | 0.67 | 0.41 | 0.59 | 0.38 | 0.55 |
| | Dependability 75% | $Mm^3/yr$ | 2.82 | 1.90 | 2.68 | 1.85 | 2.60 | 1.82 | 2.56 |
| | Dependability 50% | $Mm^3/yr$ | 4.68 | 3.23 | 4.54 | 3.18 | 4.47 | 3.15 | 4.42 |
| | Dependability 25% | $Mm^3/yr$ | 21.03 | 14.66 | 20.54 | 14.10 | 19.76 | 13.56 | 19.00 |
| Return Flows from Domestic WS | | | | | | | | | |
| - Cities and Towns | | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total | Weighted Mean | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| | Dependability 90% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| | Dependability 75% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| | Dependability 50% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| | Dependability 25% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| Total Return Flows: | Weighted Mean | $Mm^3/yr$ | 9.02 | 6.31 | 8.80 | 6.11 | 8.51 | 5.92 | 8.24 |
| | Dependability 90% | $Mm^3/yr$ | 0.88 | 0.58 | 0.78 | 0.55 | 0.73 | 0.53 | 0.70 |
| | Dependability 75% | $Mm^3/yr$ | 2.89 | 2.01 | 2.79 | 1.99 | 2.74 | 1.97 | 2.71 |
| | Dependability 50% | $Mm^3/yr$ | 4.76 | 3.35 | 4.66 | 3.32 | 4.61 | 3.31 | 4.58 |
| | Dependability 25% | $Mm^3/yr$ | 21.11 | 14.78 | 20.65 | 14.24 | 19.90 | 13.72 | 19.15 |
| Total Available GW : Wwighted Mean | | $Mm^3/yr$ | 10.62 | 7.44 | 9.93 | 7.00 | 9.41 | 6.65 | 8.97 |
| | Dependability 90% | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| | Dependability 75% | $Mm^3/yr$ | 4.49 | 3.14 | 3.92 | 2.88 | 3.64 | 2.70 | 3.44 |
| | Dependability 50% | $Mm^3/yr$ | 6.36 | 4.48 | 5.79 | 4.21 | 5.50 | 4.04 | 5.31 |
| | Dependability 25% | $Mm^3/yr$ | 22.71 | 15.91 | 21.78 | 15.13 | 20.79 | 14.45 | 19.88 |
| Total Usable GW for Irrig: Wtd. Mean | | $Mm^3/yr$ | 10.62 | 7.44 | 9.93 | 7.00 | 9.41 | 6.65 | 8.97 |
| | Dependability 90% | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| | Dependability 75% | $Mm^3/yr$ | 4.49 | 3.14 | 3.92 | 2.88 | 3.64 | 2.70 | 3.44 |
| | Dependability 50% | $Mm^3/yr$ | 6.36 | 4.48 | 5.79 | 4.21 | 5.50 | 4.04 | 5.31 |
| | Dependability 25% | $Mm^3/yr$ | 22.71 | 15.91 | 21.78 | 15.13 | 20.79 | 14.45 | 19.88 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: Wtd. Mean | | mm/yr | 144 | 101 | 134 | 95 | 127 | 90 | 121 |
| | Dependability 90% | mm/yr | 34 | 23 | 26 | 19 | 22 | 17 | 19 |
| | Dependability 75% | mm/yr | 61 | 43 | 53 | 39 | 49 | 37 | 47 |
| | Dependability 50% | mm/yr | 86 | 61 | 78 | 57 | 74 | 55 | 72 |
| | Dependability 25% | mm/yr | 307 | 215 | 295 | 205 | 281 | 195 | 269 |
| Well Yield | | $10^3 m^3/yr$ | 32 | | | | | | |
| No. of Irrigation Wells | Existing | | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | Weighted Mean | $Mm^3/yr$ | 17.27 | 19.36 | 16.49 | 18.59 | 15.78 | 17.90 | 15.16 |
| | Dependability 90% | $Mm^3/yr$ | 2.74 | 2.18 | 2.17 | 1.91 | 1.88 | 1.73 | 1.69 |
| | Dependability 75% | $Mm^3/yr$ | 6.33 | 6.48 | 5.76 | 6.22 | 5.47 | 6.04 | 5.28 |
| | Dependability 50% | $Mm^3/yr$ | 9.67 | 10.49 | 9.10 | 10.22 | 8.81 | 10.04 | 8.61 |
| | Dependability 25% | $Mm^3/yr$ | 38.86 | 44.77 | 37.66 | 42.99 | 36.11 | 41.29 | 34.64 |
| Depth | Weighted Mean | mm/yr | 234 | 262 | 223 | 251 | 213 | 242 | 205 |
| | Dependability 90% | mm/yr | 37 | 29 | 29 | 26 | 25 | 23 | 23 |
| | Dependability 75% | mm/yr | 86 | 88 | 78 | 84 | 74 | 82 | 71 |
| | Dependability 50% | mm/yr | 131 | 142 | 123 | 138 | 119 | 136 | 116 |
| | Dependability 25% | mm/yr | 526 | 606 | 509 | 581 | 488 | 558 | 469 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/km$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11138 | | | | | | |
| | Total | Mill.Rs. | | 82.35 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | 92 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | 18 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 82.35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.48 | | | | | | |
| Average Annual Cost | Mill.Rs | 5.10 | 3.57 | 4.77 | 3.36 | 4.51 | 3.19 | 4.31 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 5.10 | 3.57 | 4.77 | 3.36 | 4.51 | 3.19 | 4.31 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 5.10 | 3.57 | 4.77 | 3.36 | 4.51 | 3.19 | 4.31 |
| **VI Implementation** | | | | | | | | |
| Earliest Possible Completion Year | 2014 | | | | | | | |
| Latest Planned Completion Year | 2060 | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Weights of Dependability Levels | | | | | | | |
| | Dependability, % | 90 | 75 | 50 | 25 | | | |
| | Weight | 0.210 | 0.200 | 0.257 | 0.333 | | | |
| | % Increase over weighted mean available GW for estimating additional wells | | | | | = | | 30 |
| | CCA = Cultivable Command Area | | | | | | | |
| | CMLP = Crop Mix Linear Programming | | | | | | | |
| | GCA = Geographical Command Area | | | | | | | |
| | GW = Ground Water | | | | | | | |
| | IDZ = Irrigation demand Zone | | | | | | | |
| | SW = Surface Water | | | | | | | |
| | WS = Water Supply | | | | | | | |

**VII. Irrigation Project Planning Worksheet - CMLP Extract**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Project name: | ARWAR Irrigation Project | | | | | | | | |
| WRIS Project Code: | 0 | | | | | | | | |
| Status: | Existing | | | | Weights of Dependability Levels | | | | |
| River Basin: | Banas | | | | Dependability, % | 90 | 75 | 50 | 25 |
| Irrigation Demand Zone (IDZ) | Bhilwara | | | | Weight | 0.21 | 0.2 | 0.257 | 0.333 |
| Aquifer regulation: | No | | | | | | | | |
| . | | | 2010 | 2020 | | 2040 | | 2060 | |
| . | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 7394 | 7394 | 7394 | 7394 | 7394 | 7394 | 7394 |
| SW On-Farm Irrigation Efficiency | | % | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 |
| GW On-Farm Irrigation Efficiency | | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm | Dependability 90% | $Mm^3/yr$ | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 |
| | Dependability 75% | $Mm^3/yr$ | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 |
| | Dependability 50% | $Mm^3/yr$ | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 |
| | Dependability 25% | $Mm^3/yr$ | 16.16 | 28.87 | 15.88 | 27.85 | 15.32 | 26.84 | 14.76 |
| Total Available GW | | | | | | | | | |
| | Dependability 90% | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| | Dependability 75% | $Mm^3/yr$ | 4.49 | 3.14 | 3.92 | 2.88 | 3.64 | 2.70 | 3.44 |
| | Dependability 50% | $Mm^3/yr$ | 6.36 | 4.48 | 5.79 | 4.21 | 5.50 | 4.04 | 5.31 |
| | Dependability 25% | $Mm^3/yr$ | 22.71 | 15.91 | 21.78 | 15.13 | 20.79 | 14.45 | 19.88 |
| Firm GW for Kharif | | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| Weighted Mean multi annual GW Supply | | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | | $Mm^3/yr$ | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 |
| Peak Month GW Supply Capaciy | | $Mm^3/mo.$ | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 |
| **b. CMLP Results** | | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | | Mill.Rs/yr | 80.81 | 97.19 | 72.97 | 112.49 | 84.20 | 128.28 | 95.79 |
| CMLP Irrig. Intensity | Dependability 90% | % | 6.19 | 6.04 | 5.26 | 5.13 | 4.42 | 4.65 | 3.96 |
| | Dependability 75% | % | 14.16 | 17.67 | 13.82 | 16.41 | 12.72 | 15.93 | 12.25 |
| | Dependability 50% | % | 21.63 | 28.61 | 21.86 | 27.03 | 20.52 | 26.54 | 20.06 |
| | Dependability 25% | % | 86.75 | 121.90 | 90.44 | 113.47 | 84.07 | 108.96 | 80.66 |
| | Weighted Mean | % | 38.58 | 52.75 | 39.60 | 49.09 | 36.74 | 47.27 | 35.30 |
| CMLP GW Use | Dependability 90% | % | 90.62 | 78.52 | 88.16 | 75.52 | 86.35 | 73.01 | 84.77 |
| | Dependability 75% | % | 70.08 | 47.23 | 67.46 | 45.48 | 66.01 | 43.87 | 64.74 |
| | Dependability 25% | % | 62.71 | 38.92 | 61.58 | 38.86 | 61.17 | 37.77 | 60.27 |
| | Dependability 25% | % | 52.80 | 29.69 | 54.40 | 31.75 | 55.53 | 31.53 | 55.34 |

**VIII. Data for Present Value Assessment**

| Period | Investment Completed | Operation From | Up To | Lngth (yrs) | Start (yrs) | | Rate of Interest: | 10.00% |
|---|---|---|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 | | | |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 | | | |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 | | | |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 | | | |

| IX. Annual Cost and Benefits | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | 2020 | | 2040 | | 2060 | |
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | | Mill.Rs./yr | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 |
| Annuity Total Project Cost | | Mill.Rs./yr | 5.10 | 12.66 | 4.77 | 12.45 | 4.51 | 12.28 | 4.31 |
| Irrigation allocated Annuity Capital Cost | | Mill.Rs./yr | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 |
| Irrigation allocated Annuity Project Cost | | Mill.Rs./yr | 5.10 | 12.66 | 4.77 | 12.45 | 4.51 | 12.28 | 4.31 |
| Wtd. Mean Irrigation Benefit | | Mill.Rs./yr | 80.81 | 97.19 | 72.97 | 112.49 | 84.20 | 128.28 | 95.79 |
| Wtd.Mean net Irrigation water supply | | $Mm^3$/yr | 10.96 | 13.92 | 10.45 | 13.36 | 10.00 | 12.86 | 9.61 |
| Wtd.Mean gross Irrigation WS on farm | | $Mm^3$/yr | 17.27 | 19.36 | 16.49 | 18.59 | 15.78 | 17.90 | 15.16 |
| Wtd Mean Surface WS to Priority Sectors | | $Mm^3$/yr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **X. Present Value** | | | | | | . | | | |
| | | Unit | | With Plan | Without Plan | Difference | . | | |
| 1. Total water Supply from Project | | $Mm^3$ | | 118.31 | 100.68 | 17.63 | | | |
| 2. Gross on farm Irrigation Supply | | $Mm^3$ | | 118.31 | 100.68 | 17.63 | | | |
| 3. Water Supply to Priority Sectors | | $Mm^3$ | | 0.00 | 0.00 | 0.00 | | | |
| 4. Weighted mean Irrigation Benefits | | Mill.Rs. | | 625.51 | 469.22 | 156.29 | | | |
| 5. Total Project Costs | | Mill.Rs. | | 77.83 | 29.03 | 48.80 | | | |
| 6. Project Capital Costs | | Mill.Rs. | | 56.13 | 0.00 | 56.13 | | | |
| 7. Irrigation allocated Project Costs | | Mill.Rs. | | 77.83 | 29.03 | 48.80 | | | |
| 8. Irrigation allocated Capital Costs | | Mill.Rs. | | 56.13 | 0.00 | 56.13 | | | |
| 9. Irrigation Net Present Value (NPV) | | Mill.Rs. | | 547.67 | 440.18 | 107.49 | | | |
| **XI. Economic Indicators** | | | | | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | | $Rs./m^3$ | | 0.66 | 0.29 | | | | |
| 2. Priority Sectors Use | | % | | 0.00 | 0.00 | | | | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | | Rs/ha | | 7591 | | | | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | | - | | 2.38 | | | | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | | **2.92** | | | | | |
| Notes: | -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation. | | | | | | | | |

# Annex 5

# Imported Water Availability

# Annex 5

# Imported Water Availability

## 1. Recent Water Sharing Statements

In all the said agreements, Rajasthan is at the tail end of every system and consequently there is a shortage in supply, as the upper riparian States take more water.

The following committees have been constituted to regulate the supply to the participant States:

- Technical Committee of Bhakra Beas Management Board (BBMB), for Ravi-Beas and Sutlej projects.
- Standing Committee Nr. 2 of Madhya Pradesh - Rajasthan Interstate Board (for Chambal water).
- Mahi Control Board, for Mahi waters.
- Upper Yamuna River Board (UYRB), for Yamuna water.

In these forums, Rajasthan claims for the delivery of its current shares, but since the release of supplies is done by the States where the headworks exist, shortages are created in Rajasthan.

Table A5.1 presents the overall water utilization, in %, by partner States as analysed on the basis of data supplied by UYRB for the given years. Table A5.2, Table A5.3 and Table A5.4 show the shortages caused to Rajasthan year-wise by relevant systems. Table A5.5 and A5.6 presents the recent history of Chambal River and Mahi River water sharing, respectively. Table A5.7 presents the recent water received through Narmada Canal.

Table A5.1 Water Utilization by Partner States, %

| State | Haryana | Rajasthan | UP | Delhi | HP |
|---|---|---|---|---|---|
| Allocation as per MoU | 48 | 9 | 34 | 6 | 3 |
| Water utilized in the years | | | | | |
| 2000-01 | 73 | 3 | 22 | 3 | |
| 2001-02 | 73 | 3 | 21 | 3 | |
| 2002-03 | 75 | 3 | 19 | 3 | |
| 2003-04 | 68 | 2 | 27 | 3 | |
| 2004-05 | 69 | 2 | 25 | 4 | |
| 2005-06 | 71 | 1 | 25 | 3 | |
| 2006-07 | 70 | 2 | 25 | 3 | |
| 2007-08 | 70 | 3 | 25 | 3 | |

Table A5.2 Abstract of Ravi Beas Water Account of Partner States as per BBMB (all values in Maf)

| Period & Year | Punjab | | | | Rajasthan | | | | Haryana | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Share | Share limited to indent | Deliveries | Excess/ shortage | Share | Share limited to indent | Deliveries | Excess/ shortage | Share | Share limited to indent | Deliveries | Excess/ shortage |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 2002-03 | | | | | | | | | | | | |
| Filling | 2.120 | 2.120 | 3.334 | 1.214 | 1.900 | 1.900 | 2.190 | 0.290 | 0.597 | 0.431 | 0.418 | -0.013 |
| Depletion | 2.475 | 2.375 | 2.652 | 0.277 | 2.969 | 2.969 | 3.751 | 0.782 | 1.014 | 0.991 | 0.958 | -0.033 |
| Total | 4.595 | 4.495 | 5.986 | 1.491 | 4.869 | 4.869 | 5.941 | 1.072 | 1.611 | 1.422 | 1.376 | -0.046 |
| 2003-04 | | | | | | | | | | | | |
| Filling | 2.590 | 2.590 | 4.040 | 1.450 | 2.666 | 2.530 | 2.713 | 0.183 | 0.926 | 0.610 | 0.497 | -0.113 |
| Depletion | 2.664 | 2.505 | 3.216 | 0.711 | 3.280 | 3.280 | 3.991 | 0.711 | 1.146 | 1.088 | 1.087 | -0.001 |
| Total | 5.254 | 5.095 | 7.256 | 2.161 | 5.946 | 5.810 | 6.704 | 0.894 | 2.072 | 1.698 | 1.584 | -0.114 |
| 2004-05 | | | | | | | | | | | | |
| Filling | 2.111 | 2.111 | 3.151 | 1.040 | 1.884 | 1.884 | 1.585 | -0.299 | 0.591 | 0.525 | 0.518 | -0.007 |
| Depletion | 2.686 | 2.080 | 3.112 | 1.032 | 3.399 | 3.393 | 4.048 | 0.655 | 1.212 | 1.212 | 1.059 | -0.153 |
| Total | 4.797 | 4.191 | 6.263 | 2.072 | 5.283 | 5.277 | 5.633 | 0.356 | 1.803 | 1.737 | 1.577 | -0.160 |
| 2005-06 | | | | | | | | | | | | |
| Filling | 2.843 | 2.776 | 3.865 | 1.089 | 3.079 | 2.931 | 2.993 | 0.062 | 1.103 | 0.791 | 0.698 | -0.093 |
| Depletion | 3.008 | 2.731 | 3.177 | 0.446 | 4.058 | 4.024 | 4.781 | 0.757 | 1.494 | 1.409 | 1.326 | -0.083 |
| Total | 5.851 | 5.507 | 7.042 | 1.535 | 7.137 | 6.955 | 7.774 | 0.819 | 2.597 | 2.200 | 2.024 | -0.176 |
| 2006-07 | | | | | | | | | | | | |
| Filling | 2.441 | 2.401 | 3.279 | 0.878 | 2.423 | 1.953 | 2.520 | 0.567 | 0.822 | 0.518 | 0.430 | -0.088 |
| Depletion | 2.876 | 2.409 | 2.904 | 0.495 | 3.907 | 3.906 | 5.149 | 1.243 | 1.420 | 1.385 | 1.352 | -0.033 |
| Total | 5.317 | 4.810 | 6.183 | 1.373 | 6.330 | 5.859 | 7.669 | 1.810 | 2.242 | 1.903 | 1.782 | -0.121 |
| 2007-08 | | | | | | | | | | | | |
| Filling | 2.850 | 2.796 | 3.681 | 0.885 | 3.091 | 3.091 | 3.082 | -0.009 | 1.108 | 0.949 | 0.758 | -0.191 |
| Depletion | 2.629 | 2.543 | 3.194 | 0.651 | 3.224 | 3.210 | 3.650 | 0.440 | 1.122 | 1.122 | 1.040 | -0.082 |
| Total | 5.479 | 5.339 | 6.875 | 1.536 | 6.315 | 6.301 | 6.732 | 0.431 | 2.230 | 2.071 | 1.798 | -0.273 |
| 2008-09 | | | | | | | | | | | | |

Table A5.2 Abstract of Ravi Beas Water Account of Partner States as per BBMB (all values in Maf)

| Period & Year | Punjab | | | | Rajasthan | | | | Haryana | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Share | Share limited to indent | Deliveries | Excess/ shortage | Share | Share limited to indent | Deliveries | Excess/ shortage | Share | Share limited to indent | Deliveries | Excess/ shortage |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Filling | 2.294 | 2.175 | 3.109 | 0.934 | 2.183 | 1.995 | 2.150 | 0.155 | 0.719 | 0.541 | 0.486 | -0.055 |
| Depletion | 3.200 | 2.467 | 2.829 | 0.362 | 4.158 | 4.157 | 5.447 | 1.290 | 1.523 | 1.429 | 1.399 | -0.030 |
| Total | 5.494 | 4.642 | 5.938 | 1.296 | 6.341 | 6.152 | 7.597 | 1.445 | 2.242 | 1.970 | 1.885 | -0.085 |
| 2009-10 | | | | | | | | | | | | |
| Filling | 2.058 | 2.002 | 2.990 | 0.988 | 1.797 | 1.797 | 1.717 | -0.080 | 0.553 | 0.409 | 0.347 | -0.062 |
| Depletion | 2.207 | 2.114 | 2.760 | 0.646 | 2.536 | 2.536 | 2.440 | -0.096 | 0.828 | 0.591 | 0.580 | -0.011 |
| Total | 4.265 | 4.116 | 5.750 | 1.634 | 4.333 | 4.333 | 4.157 | -0.176 | 1.381 | 1.000 | 0.927 | -0.073 |

Table A5.3 Abstract of Shares and Utilization by Partner States of Sutlej Water as per BBMB (all values in Maf)

| Year & period | Sharable Supplies | Share of Partner States | | | | | Deliveries / Utilization | | | | | Excess / Shortage to Rajasthan | | Supplies in RF-SF Link |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Punjab | Haryana | Rajasthan | | | Punjab | Haryana | Rajasthan | | | | | |
| | | | | Via Punjab | Via Haryana | Total | | | Via Punjab | Via Haryana | Total | Via Punjab | Via Haryana | |
| 1 | 2 | 3 | 4 | 5(a) | 5(b) | 5(c) | 6 | 7 | 8(a) | 8(b) | 8(c) | 9(a) | 9(b) | 10 |
| 2002-03 | | | | | | | | | | | | | | |
| Filling | 4.655 | 2.601 | 1.576 | 0.301 | 0.177 | 0.478 | 3.294 | 1.710 | 0.068 | 0.120 | 0.188 | -0.233 | -0.057 | 0.208 |
| Depletion | 5.471 | 2.943 | 1.968 | 0.359 | 0.203 | 0.562 | 2.979 | 2.331 | 0.384 | 0.156 | 0.540 | 0.025 | -0.047 | 0.158 |
| Total | 10.126 | 5.544 | 3.544 | 0.660 | 0.380 | 1.040 | 6.273 | 4.041 | 0.452 | 0.276 | 0.728 | -0.208 | -0.104 | 0.366 |
| 2003-04 | | | | | | | | | | | | | | |
| Filling | 4.560 | 2.557 | 1.528 | 0.299 | 0.176 | 0.475 | 3.189 | 1.607 | 0.280 | 0.133 | 0.413 | -0.019 | -0.043 | 0.077 |
| Depletion | 6.490 | 3.369 | 2.415 | 0.444 | 0.262 | 0.706 | 3.840 | 2.729 | 0.455 | 0.217 | 0.672 | 0.011 | -0.045 | 0.124 |
| Total | 11.050 | 5.926 | 3.943 | 0.743 | 0.438 | 1.181 | 7.029 | 4.336 | 0.735 | 0.350 | 1.085 | -0.008 | -0.088 | 0.201 |
| 2004-05 | | | | | | | | | | | | | | |
| Filling | 3.523 | 2.040 | 1.133 | 0.220 | 0.130 | 0.350 | 2.195 | 1.217 | 0.192 | 0.074 | 0.266 | -0.028 | -0.056 | 0.039 |
| Depletion | 3.431 | 1.884 | 1.211 | 0.207 | 0.129 | 0.336 | 1.612 | 1.512 | 0.375 | 0.115 | 0.490 | 0.168 | -0.014 | 0.082 |
| Total | 6.954 | 3.924 | 2.344 | 0.427 | 0.259 | 0.686 | 3.807 | 2.729 | 0.567 | 0.189 | 0.756 | 0.140 | -0.070 | 0.121 |
| 2005-06 | | | | | | | | | | | | | | |
| Filling | 3.901 | 2.152 | 1.334 | 0.261 | 0.154 | 0.415 | 2.670 | 1.498 | 0.278 | 0.104 | 0.382 | 0.017 | -0.050 | 0.072 |
| Depletion | 5.655 | 2.826 | 2.214 | 0.376 | 0.239 | 0.615 | 3.348 | 2.640 | 0.490 | 0.206 | 0.696 | 0.114 | -0.033 | 0.089 |
| Total | 9.556 | 4.978 | 3.548 | 0.637 | 0.393 | 1.030 | 6.018 | 4.138 | 0.768 | 0.310 | 1.078 | 0.131 | -0.083 | 0.161 |
| 2006-07 | | | | | | | | | | | | | | |
| Filling | 5.543 | 3.300 | 1.795 | 0.282 | 0.166 | 0.448 | 3.548 | 1.864 | 0.300 | 0.119 | 0.419 | 0.018 | -0.047 | 0.047 |
| Depletion | 5.917 | 3.218 | 2.090 | 0.383 | 0.226 | 0.609 | 2.776 | 2.585 | 0.610 | 0.233 | 0.843 | 0.227 | 0.007 | 0.083 |
| Total | 11.460 | 6.518 | 3.885 | 0.665 | 0.392 | 1.057 | 6.324 | 4.449 | 0.910 | 0.352 | 1.262 | 0.245 | -0.040 | 0.130 |
| 2007-08 | | | | | | | | | | | | | | |
| Filling | 4.637 | 2.697 | 1.479 | 0.290 | 0.171 | 0.461 | 2.825 | 1.534 | 0.311 | 0.124 | 0.435 | 0.021 | -0.047 | 0.048 |
| Depletion | 5.385 | 2.930 | 1.903 | 0.347 | 0.205 | 0.552 | 2.800 | 2.253 | 0.442 | 0.187 | 0.629 | 0.095 | -0.018 | 0.008 |

| Year & period | Sharable Supplies | Share of Partner States | | | | | Deliveries / Utilization | | | | | Excess / Shortage to Rajasthan | | Supplies in RF-SF Link |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Punjab | Haryana | Rajasthan | | | Punjab | Haryana | Rajasthan | | | | | |
| | | | | Via Punjab | Via Haryana | Total | | | Via Punjab | Via Haryana | Total | Via Punjab | Via Haryana | |
| 1 | 2 | 3 | 4 | 5(a) | 5(b) | 5(c) | 6 | 7 | 8(a) | 8(b) | 8(c) | 9(a) | 9(b) | 10 |
| Total | 10.022 | 5.627 | 3.382 | 0.637 | 0.376 | 1.013 | 5.625 | 3.787 | 0.753 | 0.311 | 1.064 | 0.116 | -0.065 | 0.056 |
| 2008-09 | | | | | | | | | | | | | | |
| Filling | 4.163 | 2.309 | 1.413 | 0.277 | 0.164 | 0.441 | 2.730 | 1.553 | 0.285 | 0.148 | 0.433 | 0.008 | -0.016 | 0.018 |
| Depletion | 5.348 | 2.693 | 2.051 | 0.380 | 0.224 | 0.604 | 3.051 | 2.371 | 0.564 | 0.282 | 0.846 | 0.184 | 0.058 | 0.089 |
| Total | 9.511 | 5.002 | 3.464 | 0.657 | 0.388 | 1.045 | 5.781 | 3.924 | 0.849 | 0.430 | 1.279 | 0.192 | 0.042 | 0.107 |
| 2009-10 | | | | | | | | | | | | | | |
| Filling | 4.835 | 2.754 | 1.594 | 0.306 | 0.180 | 0.486 | 2.987 | 1.686 | 0.307 | 0.126 | 0.433 | 0.001 | -0.054 | 0.018 |
| Depletion | 5.182 | 2.906 | 1.764 | 0.322 | 0.190 | 0.512 | 2.720 | 2.046 | 0.356 | 0.153 | 0.509 | 0.034 | -0.037 | 0.032 |
| Total | 10.017 | 5.660 | 3.358 | 0.628 | 0.370 | 0.998 | 5.707 | 3.732 | 0.663 | 0.279 | 0.942 | 0.035 | -0.091 | 0.050 |

Table A5.4 Utilization Statement of Yamuna Water in Bharatpur District (all values in cusec days, unless specified)

| Year and Month | Water availability at Okhla | Rajasthan Share | Rajasthan Share as per UYRB, % | Water Release by UP | | | Water Received in Rajasthan | | | Water availability in respect of Rajasthan release from Okhla, % | Water availability in respect of release by UP, % | Water availability in respect of UP release in Gurgaon Canal, % | Water availability in respect of UP release in Bharatpur Feeder, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bharatpur Feeder | Gurgaon Main Canal | Total | Bharatpur Feeder | Gurgaon Main Canal | Total | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 2005 | | | | | | | | | | | | | |
| Jan | 11,712 | 2,495 | 21.30 | 0 | 2,650 | 2,650 | 578 | 580 | 1,158 | 46.41 | 43.70 | 21.89 | |
| Feb | 14,640 | 3,145 | 21.48 | 2,080 | 1,900 | 3,980 | 909 | 1,101 | 2,010 | 63.91 | 50.50 | 57.95 | 43.70 |
| Mar | 13,086 | 2,879 | 22.00 | 874 | 2,575 | 3,449 | 1,204 | 1,694 | 2,898 | 100.66 | 84.02 | 65.79 | 137.76 |
| Apr | 9,828 | 2,161 | 21.99 | 640 | 4,350 | 4,990 | 63 | 3,223 | 3,286 | 152.06 | 65.85 | 74.09 | 9.84 |
| May | 8,563 | 1,887 | 22.04 | 1,664 | 1,950 | 3,614 | 1,288 | 1,057 | 2,345 | 124.27 | 64.89 | 54.21 | 77.40 |
| Jun | 8,240 | 1,813 | 22.00 | 908 | 1,420 | 2,328 | 820 | 375 | 1,195 | 65.91 | 51.33 | 26.41 | 90.31 |
| Jul | 43,527 | 6,528 | 15.00 | 3,678 | 105 | 3,783 | 698 | 424 | 1,122 | 17.19 | 29.66 | 403.81 | 18.98 |
| Aug | 51,633 | 7,740 | 14.99 | 1,363 | 2,900 | 4,263 | 686 | 1,093 | 1,779 | 22.98 | 41.73 | 37.69 | 50.33 |
| Sep | 35,388 | 5,308 | 15.00 | 896 | 3,750 | 4,646 | 1,341 | 1,116 | 2,457 | 46.29 | 52.88 | 29.76 | 149.67 |
| Oct | 28,963 | 4,345 | 15.00 | 0 | 450 | 450 | 0 | 370 | 370 | 8.52 | 82.22 | 82.22 | |
| Nov | 13,484 | 2,832 | 21.00 | 1,158 | 300 | 1,458 | 2,150 | 193 | 2,343 | 82.73 | 160.70 | 64.33 | 185.66 |
| Dec | 9,179 | 1,930 | 21.03 | 1,352 | 1,250 | 2,602 | 772 | 396 | 1,168 | 60.52 | 44.89 | 31.68 | 57.10 |
| Total | 248,243 | 43,063 | 17.35 | 14,613 | 23,600 | 38,213 | 10,509 | 11,622 | 22,131 | 51.39 | 57.91 | 49.25 | 71.92 |
| 2006 | | | | | | | | | | | | | |
| Jan | 9,937 | 2,086 | 20.99 | 1,863 | 350 | 2,213 | 191 | 0 | 191 | 9.16 | 8.63 | 0.00 | 10.25 |
| Feb | 8,751 | 1,836 | 20.98 | 1,045 | 0 | 1,045 | 786 | 0 | 786 | 42.81 | 75.22 | | 75.22 |
| Mar | 7,204 | 1,613 | 22.39 | 2,461 | 1,800 | 4,261 | 948 | 255 | 1,203 | 74.58 | 28.23 | 14.17 | 38.52 |
| Apr | 5,789 | 1,272 | 21.97 | 0 | 1,650 | 1,650 | 0 | 1,450 | 1,450 | 113.99 | 87.88 | 87.88 | |
| May | 13,186 | 2,056 | 15.59 | 1,040 | 1,550 | 2,590 | 300 | 470 | 770 | 37.45 | 29.73 | 30.32 | 28.85 |
| Jun | 16,396 | 6,000 | 36.59 | 2,661 | 1,500 | 4,161 | 1,240 | 491 | 1,731 | 28.85 | 41.60 | 32.73 | 46.60 |
| Jul | 34,191 | 6,200 | 18.13 | 2,331 | 2,550 | 4,881 | 1,016 | 212 | 1,228 | 19.81 | 25.16 | 8.31 | 43.59 |
| Aug | 77,479 | 6,200 | 8.00 | NR | 4,650 | 4,650 | 2,154 | 738 | 2,892 | 46.65 | 62.19 | 15.87 | |

| Year and Month | Water availability at Okhla | Rajasthan Share | Rajasthan Share as per UYRB, % | Water Release by UP | | | Water Received in Rajasthan | | | Water availability in respect of Rajasthan release from Okhla, % | Water availability in respect of release by UP, % | Water availability in respect of UP release in Gurgaon Canal, % | Water availability in respect of UP release in Bharatpur Feeder, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bharatpur Feeder | Gurgaon Main Canal | Total | Bharatpur Feeder | Gurgaon Main Canal | Total | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Sep | 23,980 | 6,000 | 25.02 | 2,788 | 2,300 | 5,088 | 1,584 | 445 | 2,029 | 33.82 | 39.88 | 19.35 | 56.81 |
| Oct | 20,771 | 3,122 | 15.03 | 0 | 4,350 | 4,350 | 60 | 1,163 | 1,223 | 39.17 | 28.11 | 26.74 | |
| Nov | 8,399 | 1,762 | 20.98 | 1,840 | 1,025 | 2,865 | 1,100 | 18 | 1,118 | 63.45 | 39.02 | 1.76 | 59.78 |
| Dec | 9,221 | 1,934 | 20.97 | 751 | 1,750 | 2,501 | 790 | 214 | 1,004 | 51.91 | 40.14 | 12.23 | 105.19 |
| Total | 235,304 | 40,081 | 17.03 | 16,780 | 23,475 | 40,255 | 10,169 | 5,456 | 15,625 | 38.98 | 38.82 | 23.24 | 60.60 |
| 2007 | | | | | | | | | | | | | |
| Jan | 4,491 | 1,032 | 22.98 | 650 | 403 | 1,053 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| Feb | 6,844 | 1,395 | 20.38 | 1,800 | 2,577 | 4,377 | 906 | 1,287 | 2,193 | 157.20 | 50.10 | 49.94 | 50.33 |
| Mar | 5,749 | 1,283 | 22.32 | 4,300 | 312 | 4,612 | 1,279 | 253 | 1,532 | 119.41 | 33.22 | 81.09 | 29.74 |
| Apr | 14,530 | 3,197 | 22.00 | 4,500 | 1,927 | 6,427 | 2,132 | 741 | 2,873 | 89.87 | 44.70 | 38.45 | 47.38 |
| May | 17,830 | 3,827 | 21.46 | 2,400 | 856 | 3,256 | 982 | 255 | 1,237 | 32.32 | 37.99 | 29.79 | 40.92 |
| Jun | 25,709 | 5,657 | 22.00 | 1,500 | 1,003 | 2,503 | 0 | 1,159 | 1,159 | 20.49 | 46.30 | 115.55 | 0.00 |
| Jul | 39,077 | 5,862 | 15.00 | 3,350 | 4,984 | 8,334 | 98 | 1,521 | 1,619 | 27.62 | 19.43 | 30.52 | 2.93 |
| Aug | 80,028 | 9,005 | 11.25 | 4,050 | 7,283 | 11,333 | 301 | 2,271 | 2,572 | 28.56 | 22.69 | 31.18 | 7.43 |
| Sep | 35,181 | 5,279 | 15.01 | 2,900 | 2,221 | 5,121 | 565 | 1,379 | 1,944 | 36.83 | 37.96 | 62.09 | 19.48 |
| Oct | 2,427 | 400 | 16.48 | 4,350 | NR | 4,350 | 2,120 | 290 | 2,410 | 602.50 | 55.40 | | 48.74 |
| Nov | 18,938 | 3,554 | 18.77 | 2,700 | 310 | 3,010 | 813 | 156 | 969 | 27.27 | 32.19 | 50.32 | 30.11 |
| Dec | 20,109 | 4,224 | 21.01 | 300 | 4,937 | 5,237 | 76 | 2,646 | 2,722 | 64.44 | 51.98 | 53.60 | 25.33 |
| Total | 270,913 | 44,715 | 16.51 | 32,800 | 26,813 | 59,613 | 9,272 | 11,958 | 21,230 | 47.48 | 35.61 | 44.60 | 28.27 |
| 2008 | | | | | | | | | | | | | |
| Jan | 17,849 | 3,711 | 20.79 | 2,691 | 2,250 | 4,941 | 882 | 19 | 901 | 24.28 | 18.24 | 0.84 | 32.78 |
| Feb | 15,398 | 3,233 | 21.00 | 1,742 | 1,950 | 3,692 | 599 | 6 | 605 | 18.71 | 16.39 | 0.31 | 34.39 |
| Mar | 8,427 | 1,851 | 21.97 | 2,969 | 1,050 | 4,019 | 2,646 | 0 | 2,646 | 142.95 | 65.84 | 0.00 | 89.12 |
| Apr | 15,986 | 3,516 | 21.99 | 1,001 | 5,450 | 6,451 | 481 | 1,979 | 2,460 | 69.97 | 38.13 | 36.31 | 48.05 |

| Year and Month | Water availability at Okhla | Rajasthan Share | Rajasthan Share as per UYRB, % | Water Release by UP | | | Water Received in Rajasthan | | | Water availability in respect of Rajasthan release from Okhla, % | Water availability in respect of release by UP, % | Water availability in respect of UP release in Gurgaon Canal, % | Water availability in respect of UP release in Bharatpur Feeder, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bharatpur Feeder | Gurgaon Main Canal | Total | Bharatpur Feeder | Gurgaon Main Canal | Total | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| May | 16,267 | 3,579 | 22.00 | 873 | 2,150 | 3,023 | 1,302 | 906 | 2,208 | 61.69 | 73.04 | 42.14 | 149.14 |
| Jun | 36,952 | 8,127 | 21.99 | 3,244 | 2,400 | 5,644 | 1,331 | 1,380 | 2,711 | 33.36 | 48.03 | 57.50 | 41.03 |
| Jul | 60,680 | 9,102 | 15.00 | 5,261 | 4,650 | 9,911 | 1,846 | 1,871 | 3,717 | 40.84 | 37.50 | 40.24 | 35.09 |
| Aug | 69,707 | 10,458 | 15.00 | 5,873 | 4,600 | 10,473 | 3,161 | 2,191 | 5,352 | 51.18 | 51.10 | 47.63 | 53.82 |
| Sep | 41,737 | 6,262 | 15.00 | 4,428 | 1,800 | 6,228 | 2,293 | 564 | 2,857 | 45.62 | 45.87 | 31.33 | 51.78 |
| Oct | 14,742 | 2,210 | 14.99 | 0 | 4,650 | 4,650 | 7 | 1,827 | 1,834 | 82.99 | 39.44 | 39.29 | |
| Nov | 45,173 | 9,485 | 21.00 | 4,429 | 2,400 | 6,829 | 2,961 | 1,577 | 4,538 | 47.84 | 66.45 | 65.71 | 66.85 |
| Dec | 28,957 | 6,082 | 21.00 | 0 | 1,500 | 1,500 | 2,858 | 450 | 3,308 | 54.39 | 220.53 | 30.00 | |
| Total | 371,875 | 67,616 | 18.18 | 32,511 | 34,850 | 67,361 | 20,367 | 12,770 | 33,137 | 49.01 | 49.19 | 36.64 | 62.65 |
| 2009 | | | | | | | | | | | | | |
| Jan | 23,505 | 4,934 | 20.99 | 2,954 | 4,000 | 6,954 | 2,173 | 36 | 2,209 | 44.77 | 31.77 | 0.90 | 73.56 |
| Feb | 16,814 | 3,530 | 20.99 | 1,386 | 1,900 | 3,286 | 381 | 454 | 835 | 23.65 | 25.41 | 23.89 | 27.49 |
| Mar | 14,472 | 3,185 | 22.01 | 3,782 | 1,300 | 5,082 | 1,092 | 141 | 1,233 | 38.71 | 24.26 | 10.85 | 28.87 |
| Apr | 17,062 | 3,759 | 22.03 | 2,008 | 2,200 | 4,208 | 402 | 493 | 895 | 23.81 | 21.27 | 22.41 | 20.02 |
| May | 14,149 | 3,116 | 22.02 | 1,980 | 2,100 | 4,080 | 1,007 | 127 | 1,134 | 36.39 | 27.79 | 6.05 | 50.86 |
| Jun | 14,599 | 3,114 | 21.33 | 699 | 2,500 | 3,199 | 814 | 621 | 1,435 | 46.08 | 44.86 | 24.84 | 116.45 |
| Jul | 19,025 | 2,854 | 15.00 | 0 | 2,050 | 2,050 | 0 | 196 | 196 | 6.87 | 9.56 | 9.56 | |
| Aug | 23,954 | 3,596 | 15.01 | 0 | 3,450 | 3,450 | 259 | 0 | 259 | 7.20 | 7.51 | 0.00 | |
| Sep | 64,516 | 9,677 | 15.00 | 5,408 | 3,400 | 8,808 | 2,656 | 1,511 | 4,167 | 43.06 | 47.31 | 44.44 | 49.11 |
| Oct | 18,143 | 2,725 | 15.02 | 2,607 | 4,650 | 7,257 | 778 | 2,519 | 3,297 | 120.99 | 45.43 | 54.17 | 29.84 |
| Nov | 5,315 | 1,114 | 20.96 | 3,084 | 166 | 3,250 | 1,079 | 576 | 1,655 | 148.56 | 50.92 | 346.99 | 34.99 |
| Dec | 15,133 | 3,177 | 20.99 | 1,703 | 900 | 2,603 | 867 | 148 | 1,015 | 31.95 | 38.99 | 16.44 | 50.91 |
| Total | 246,687 | 44,781 | 18.15 | 25,611 | 28,616 | 54,227 | 11,508 | 6,822 | 18,330 | 40.93 | 33.80 | 23.84 | 44.93 |
| 2010 | | | | | | | | | | | | | |

| Year and Month | Water availability at Okhla | Rajasthan Share | Rajasthan Share as per UYRB, % | Water Release by UP | | | Water Received in Rajasthan | | | Water availability in respect of Rajasthan release from Okhla, % | Water availability in respect of release by UP, % | Water availability in respect of UP release in Gurgaon Canal, % | Water availability in respect of UP release in Bharatpur Feeder, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bharatpur Feeder | Gurgaon Main Canal | Total | Bharatpur Feeder | Gurgaon Main Canal | Total | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Jan | 12,989 | 2,726 | 20.99 | 2,154 | 900 | 3,054 | 1,937 | 33 | 1,970 | 72.27 | 64.51 | 3.67 | 89.93 |
| Feb | 13,057 | 2,766 | 21.18 | 1,404 | 1,650 | 3,054 | 802 | 275 | 1,077 | 38.94 | 35.27 | 16.67 | 57.12 |
| Mar | 12,749 | 2,804 | 21.99 | 1,878 | 2,600 | 4,478 | 1,101 | 1,498 | 2,599 | 92.69 | 58.04 | 57.62 | 58.63 |
| Apr | 8,442 | 1,857 | 22.00 | 3,390 | 1,500 | 4,890 | 2,319 | 1,156 | 3,475 | 187.13 | 71.06 | 77.07 | 68.41 |
| May | 9,065 | 1,993 | 21.99 | 1,741 | 2,000 | 3,741 | 955 | 461 | 1,416 | 71.05 | 37.85 | 23.05 | 54.85 |
| Jun | 11,511 | 2,533 | 22.01 | 633 | 2,000 | 2,633 | 195 | 823 | 1,018 | 40.19 | 38.66 | 41.15 | 30.81 |
| Jul | 40,162 | 6,024 | 15.00 | 2,459 | 3,650 | 6,109 | 667 | 581 | 1,248 | 20.72 | 20.43 | 15.92 | 27.12 |
| Aug | 66,850 | 10,029 | 15.00 | 4,929 | 3,350 | 8,279 | 1,772 | 1,455 | 3,227 | 32.18 | 38.98 | 43.43 | 35.95 |
| Sep | 20,764 | 3,119 | 15.02 | 862 | 1,450 | 2,312 | 452 | 848 | 1,300 | 41.68 | 56.23 | 58.48 | 52.44 |
| Oct | 7,360 | 1,112 | 15.11 | 0 | 0 | 0 | 268 | 460 | 728 | 65.47 | | | |
| Nov | 10,975 | 2,306 | 21.01 | 2,321 | 0 | 2,321 | 1,381 | 378 | 1,759 | 76.28 | 75.79 | | 59.50 |
| Dec | 24,366 | 5,117 | 21.00 | 493 | 700 | 1,193 | 132 | 0 | 132 | 2.58 | 11.06 | 0.00 | 26.77 |
| Total | 238,290 | 42,386 | 17.79 | 22,264 | 19,800 | 42,064 | 11,981 | 7,968 | 19,949 | 47.07 | 47.43 | 40.24 | 53.81 |
| 2011 | | | | | | | | | | | | | |
| Jan | 26,293 | 5,311 | 20.20 | 1,102 | 2,550 | 3,652 | 849 | 0 | 849 | 15.99 | 23.25 | 0.00 | 77.04 |
| Total | 26,293 | 5,311 | 20.20 | 1,102 | 2,550 | 3,652 | 849 | 0 | 849 | 15.99 | 23.25 | 0.00 | 77.04 |

Table A5.5 Chambal Water Release to MP and Rajasthan for the last 14 years (1994/95 to 2009/10)

| S. No. | Year | GS Dam disch. in cusec days | RPS Dam disch. in cusec days | JS Dam disch. in cusec days | RMC disch. in cusec days | LMC disch. in cusec days | Total in cusec days | Water delivered to M.P. in cusec days | Water A/c. of M.P. in cusecs days | Water A/c. of M.P. in M.A.F. | Water A/c. of Raj. in cusecs days | Water account of Raj. In M.A.F. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1994-95 | 1110559 | 1517152 | 1562980 | 1019554 | 225101 | 1244655 | 571277 | 671000 | 1.33086 | 573655 | 1.13778 |
| 2 | 1995-96 | 1092404 | 1452378 | 1484144 | 948984 | 230350 | 1179334 | 524551 | 674884 | 1.33086 | 504450 | 1.00052 |
| 3 | 1996-97 | 1326527 | 1489836 | 1486019 | 1025500 | 229536 | 1255036 | 547885 | 704195 | 1.3967 | 550841 | 1.09253 |
| 4 | 1997-98 | 1148256 | 1251398 | 1280884 | 859771 | 191020 | 1050791 | 422616 | 567816 | 1.1262 | 482975 | 0.95793 |
| 5 | 1998-99 | 2069801 | 1293957 | 1316697 | 953927 | 231535 | 1185462 | 416915 | 582209 | 1.15475 | 603253 | 1.19649 |
| 6 | 1999-2000 | 1178020 | 1077650 | 976933 | 752389 | 185574 | 937963 | 262625 | 388465 | 0.77048 | 549498 | 1.08987 |
| 7 | 2000-01 | 284202 | 502326 | 549246 | 410090 | 68675 | 478765 | 191776 | 290693 | 0.55672 | 198072 | 0.39285 |
| 8 | 2001-02 | 368910 | 810855 | 821491 | 618332 | 126007 | 744339 | 306150 | 453917 | 0.90029 | 294502 | 0.58411 |
| 9 | 2003-04 | 667842 | 744563 | 778203 | 527053 | 133748 | 660801 | 253885 | 436632 | 0.86601 | 224169 | 0.4461 |
| 10 | 2004-05 | 1465184 | 1239361 | 1294482 | 911384 | 203308 | 1114692 | 455879 | 662166 | 1.31334 | 452526 | 0.89754 |
| 11 | 2005-06 | 565056 | 894807 | 965030 | 667024 | 142626 | 809650 | 306720 | 500320 | 0.99233 | 309340 | 0.61354 |
| 12 | 2006-07 | 2776050 | 2756188 | 2892831 | 1484925 | 232678 | 1717603 | 1254440 | 565008 | 1.1206 | 638822 | 1.2670 |
| 13 | 2007-08 | 2046719 | 2107016 | 2048263 | 1041530 | 271979 | 1313509 | 480110 | 600128 | 1.1903 | 713381 | 1.4149 |
| 14 | 2008-09 | 693037 | 1228244 | 1359550 | 753942 | 200501 | 954443 | 352060 | 435724 | 0.8642 | 517894 | 1.0272 |
| 15 | 2009-10 | 338280 | 476335 | 522818 | 329722 | 95471 | 425193 | 140419 | 159248 | 0.3159 | 263745 | 0.5231 |

Table A5.6 Water Release to Gujarat from Mahi Bajaj Sagar Before and after Commencement of Power Houses

| S. No. | Year | Max. Level in Monsoon Period, m | Gross Storage at Max. Level, $Mm^3$ | Live Storage at Max. from PH-I, $Mm^3$ | Water Release to Gujarat, $Mm^3$ | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | Kagdi Spillway after Generation of PH-I | Power House II | Total | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | 1985-86 | 276.80 | 1,570.31 | 1,223.71 | 625.38 | 0.00 | 625.38 | [1] |
| 2 | 1986-87 | 280.70 | 2,057.70 | 1,709.97 | 1,202.16 | 0.00 | 1,202.16 | |
| 3 | 1987-88 | 280.00 | 1,966.72 | 1,619.84 | 1,240.87 | 0.00 | 1,240.87 | |
| 4 | 1988-89 | 281.50 | 2,180.40 | 1,966.72 | 1,165.78 | 153.79 | 1,319.57 | [2] |
| 5 | 1989-90 | 276.65 | 1,547.57 | 1,207.49 | 151.18 | 702.00 | 853.18 | |
| 6 | 1990-91 | 280.75 | 2,065.18 | 1,713.17 | 687.45 | 763.37 | 1,450.82 | |
| 7 | 1991-92 | 280.75 | 2,065.18 | 1,713.17 | 584.86 | 786.98 | 1,371.84 | |
| 8 | 1992-93 | 275.40 | 1,442.43 | 1,085.92 | 89.03 | 391.23 | 480.26 | |
| 9 | 1993-94 | 280.75 | 2,065.18 | 1,713.17 | 626.91 | 979.28 | 1,606.19 | |
| 10 | 1994-95 | 280.75 | 2,065.18 | 1,713.17 | 931.45 | 1,016.91 | 1,948.36 | |
| 11 | 1995-96 | 280.75 | 2,065.18 | 1,713.17 | 292.88 | 817.39 | 1,110.27 | |
| 12 | 1996-97 | 280.75 | 2,065.18 | 1,713.17 | 584.49 | 953.74 | 1,538.23 | |
| 13 | 1997-98 | 280.75 | 2,065.18 | 1,713.17 | 529.24 | 914.10 | 1,443.34 | |
| 14 | 1998-99 | 280.75 | 2,065.18 | 1,713.17 | 321.28 | 741.11 | 1,062.39 | |
| 15 | 1999-00 | 270.15 | 958.21 | 1,713.17 | 179.87 | 119.04 | 298.91 | |
| 16 | 2000-01 | 266.02 | 672.10 | 326.63 | 0.88 | 100.10 | 100.98 | |
| 17 | 2001-02 | 271.20 | 1,047.21 | 700.76 | 1.61 | 114.68 | 116.29 | [3] |
| 18 | 2002-03 | 266.90 | 722.08 | 378.03 | 3.00 | 0.00 | 3.00 | |
| 19 | 2003-04 | 281.50 | 2,180.40 | 1,833.52 | 65.55 | 569.65 | 635.20 | |
| 20 | 2004-05 | 281.50 | 2,180.40 | 1,833.52 | 217.84 | 661.20 | 879.04 | |
| 21 | 2005-06 | 280.50 | 2,039.15 | 1,692.21 | 23.76 | 235.09 | 258.85 | |
| 22 | 2006-07 | 281.50 | 2,180.40 | 1,833.52 | 707.18 | 393.72 | 1,100.90 | |
| 23 | 2007-08 | 281.50 | 2,180.40 | 1,833.52 | 542.10 | 497.87 | 1,039.97 | |
| 24 | 2008-09 | 273.75 | 1,271.23 | 924.26 | 6.88 | 112.45 | 119.33 | |
| 25 | 2009-10 | 275.00 | 1,394.12 | 1,047.16 | 11.78 | 102.08 | 113.86 | |
| 26 | 2010-11 | 274.35 | 1,332.73 | 985.85 | 0.00 | 50.97 | 50.97 | |

[1] Commencement of power house I in Feb. 1986
[2] Commencement of power house II in Feb. 1989
[3] 113.27 $Mm^3$ released from dead storage (under sluices)

Table A5.7 Water Received through Narmada Canal as of March 2008

| Month/ Year | Indent of Water, cusec days | Water received | |
|---|---|---|---|
| | | Cusec days | $Mm^3$ |
| Mar-08 | 500 | 172 | 0.42 |
| Apr-08 | 3000 | 577 | 1.41 |
| May-08 | 3100 | 1293 | 3.16 |

| Month/ Year | Indent of Water, cusec days | Water received | |
|---|---|---|---|
| | | Cusec days | $Mm^3$ |
| Jun-08 | 3000 | 1115 | 2.73 |
| Jul-08 | 3100 | 785 | 1.92 |
| Aug-08 | 3100 | 1233 | 3.02 |
| Sep-08 | 3000 | 1096 | 2.68 |
| Oct-08 | 3100 | 1281 | 3.13 |
| Nov-08 | 6700 | 1574 | 3.85 |
| Dec-08 | 8100 | 3149 | 7.70 |
| Jan-09 | 4650 | 2679 | 6.55 |
| Feb-09 | 4200 | 610 | 1.49 |
| Mar-09 | 4650 | 2005 | 4.90 |
| Apr-09 | 5200 | 1590 | 3.89 |
| May-09 | 6200 | 1012 | 2.48 |
| Jun-09 | 4000 | 4020 | 9.83 |
| Jul-09 | 3120 | 2370 | 5.80 |
| Aug-09 | 2380 | 1250 | 3.06 |
| Sep-09 | 6650 | 6605 | 16.16 |
| Oct-09 | 6650 | 4659 | 11.40 |
| Nov-09 | 7500 | 2424 | 5.93 |
| Dec-09 | 7750 | 5071 | 12.40 |
| Jan-10 | 7500 | 7855 | 19.21 |
| Feb-10 | 5850 | 6485 | 15.86 |
| Mar-10 | 3000 | 2555 | 6.25 |
| Apr-10 | 0 | 0 | 0.00 |
| May-10 | 4750 | 3415 | 8.35 |
| Jun-10 | 4100 | 3913 | 9.57 |
| Jul-10 | 2560 | 3129 | 7.65 |
| Aug-10 | 830 | 968 | 2.37 |
| Sep-10 | 450 | 477 | 1.17 |
| Oct-10 | 1965 | 1155 | 2.83 |
| Nov-10 | 2600 | 2590 | 6.34 |
| Dec-10 | 13900 | 9135 | 22.34 |
| Jan-11 | 11400 | 10355 | 25.33 |
| Feb-11 | 10950 | 10536 | 25.77 |
| Mar-11 | 8900 | 8845 | 21.63 |
| Apr-11 | 3650 | 4147 | 10.14 |
| May-11 | 7300 | 4345 | 10.63 |
| Jun-11 | 7500 | 3780 | 9.25 |
| Jul-11 | 4750 | 5325 | 13.02 |
| Aug-11 | 3300 | 4899 | 11.98 |

| Month/ Year | Indent of Water, cusec days | Water received | |
|---|---|---|---|
| | | Cusec days | $Mm^3$ |
| Sep-11 | 1150 | 3573 | 8.74 |
| Oct-11 | 0 | 1660 | 4.06 |
| Nov-11 | 11300 | 9483 | 23.20 |
| Dec-11 | 19825 | 18338 | 44.85 |
| Jan-12 | 17700 | 14033 | 34.32 |
| Feb-12 | 13050 | 12288 | 30.06 |
| Mar-12 | 6350 | 8909 | 21.79 |
| Apr-12 | 3000 | 5759 | 14.09 |
| May-12 | 3100 | 4992 | 12.21 |
| Jun-12 | 3000 | 3661 | 8.95 |

## 2. Imported Water during 2009-10

Table A5.8 summarises the import of water to Rajasthan from other States during year 2009-10.

Table A5.8 Water Received from other States during 2009-10

| State | Period | Quantity, $Mm^3$/yr |
|---|---|---|
| Punjab | | |
| Ravi – Beas waters | 2009-10 | 5,133.0 |
| Sutlej waters | 2009-10 | 1,163.0 |
| Haryana (Yamuna waters) | Jan 2010 to Dec 2010 | 19.5 |
| Uttar Pradesh (Yamuna waters) | Jan 2010 to Dec 2010 | 29.3 |
| Madhya Pradesh (Chambal waters) | 2009-10 | 390.0 |
| Madhya Pradesh (Mahi waters) | 2009-10 | 803.6 |
| Gujarat (Narmada canal) | Jan 2010 to Dec. 2010 | 101.9 |
| | Total | 7640.3 |

# Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Arwar Irrigation Project**

## I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Bhilwara | Name(s): | |
| Groundwater Potential Zone (PZ) | shahpura | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 580 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 43.99 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

## II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.44 | 0.89 | 0.89 | 1.10 | 1.10 | 1.23 | 1.23 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.39 | 0.41 | 0.41 | 0.44 | 0.44 | 0.47 | 0.47 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 7,394 | 7,394 | 7,394 | 7,394 | 7,394 | 7,394 | 7,394 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 16.98 | | | | | | |
| 2010 Irrigated Area | | ha | 3905 | | | | | | |

## III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 27.89 | 27.89 | 27.89 | 27.89 | 27.89 | 27.89 | 27.89 |
| Dependability 90% | $Mm^3/yr$ | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| Dependability 75% | $Mm^3/yr$ | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Dependability 50% | $Mm^3/yr$ | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| Dependability 25% | $Mm^3/yr$ | 45.30 | 45.30 | 45.30 | 45.30 | 45.30 | 45.30 | 45.30 |
| Weighted Mean | $Mm^3/yr$ | 18.54 | 18.54 | 18.54 | 18.54 | 18.54 | 18.54 | 18.54 |
| Losses from Reservoir Annual | % | 14.85 | | | | | | |
| During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.08 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.76 | 0.76 | 2.28 | 2.28 | 3.80 | 3.80 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 43.99 | 43.23 | 43.23 | 41.71 | 41.71 | 40.19 | 40.19 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 16.79 | 16.56 | 16.56 | 16.09 | 16.09 | 15.62 | 15.62 |
| Dependability 90% | $Mm^3/yr$ | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| Dependability 75% | $Mm^3/yr$ | 4.64 | 4.64 | 4.64 | 4.64 | 4.64 | 4.64 | 4.64 |
| Dependability 50% | $Mm^3/yr$ | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 | 8.35 |
| Dependability 25% | $Mm^3/yr$ | 40.80 | 40.09 | 40.09 | 38.68 | 38.68 | 37.27 | 37.27 |
| On-Farm Irrigation Efficiency | % | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 |
| Off-Farm Irrigation Efficiency | % | 39.60 | 72.00 | 39.60 | 72.00 | 39.60 | 72.00 | 39.60 |
| Present Overall Irrigation Efficiency | % | 28.03 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 6.65 | 11.92 | 6.56 | 11.58 | 6.37 | 11.25 | 6.19 |
| Dependability 90% | $Mm^3/yr$ | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 |
| Dependability 75% | $Mm^3/yr$ | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 |
| Dependability 50% | $Mm^3/yr$ | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 |
| Dependability 25% | $Mm^3/yr$ | 16.16 | 28.87 | 15.88 | 27.85 | 15.32 | 26.84 | 14.76 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 90 | 161 | 89 | 157 | 86 | 152 | 84 |
| Dependability 90% | mm/yr | 3 | 6 | 3 | 6 | 3 | 6 | 3 |
| Dependability 75% | mm/yr | 25 | 45 | 25 | 45 | 25 | 45 | 25 |
| Dependability 50% | mm/yr | 45 | 81 | 45 | 81 | 45 | 81 | 45 |
| Dependability 25% | mm/yr | 218 | 390 | 215 | 377 | 207 | 363 | 200 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 10.20 | 10.02 | 10.02 | 9.67 | 9.67 | 9.32 | 9.32 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.44 | 0.69 | 0.69 | 1.20 | 1.20 | 1.70 | 1.70 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 1.31 | 2.07 | 2.07 | 3.59 | 3.59 | 5.11 | 5.11 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 2.43 | 2.43 | 2.43 | 2.43 | 2.43 | 2.43 | 2.43 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 50.38 | | 50.38 | | 50.38 | | 50.38 |
| Weighted Mean | $Mm^3/yr$ | 8.46 | 5.96 | 8.34 | 5.79 | 8.11 | 5.62 | 7.87 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.23 | 0.33 | 0.23 | 0.33 | 0.23 | 0.33 |
| Dependability 75% | $Mm^3/yr$ | 2.34 | 1.67 | 2.34 | 1.67 | 2.34 | 1.67 | 2.34 |
| Dependability 50% | $Mm^3/yr$ | 4.20 | 3.00 | 4.20 | 3.00 | 4.20 | 3.00 | 4.20 |
| Dependability 25% | $Mm^3/yr$ | 20.55 | 14.43 | 20.20 | 13.93 | 19.49 | 13.42 | 18.78 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| Dependability 90% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| Dependability 50% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| Dependability 25% | $Mm^3/yr$ | 0.48 | 0.23 | 0.34 | 0.18 | 0.27 | 0.15 | 0.22 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 8.94 | 6.19 | 8.68 | 5.97 | 8.37 | 5.77 | 8.09 |
| Dependability 90% | $Mm^3/yr$ | 0.81 | 0.46 | 0.67 | 0.41 | 0.59 | 0.38 | 0.55 |
| Dependability 75% | $Mm^3/yr$ | 2.82 | 1.90 | 2.68 | 1.85 | 2.60 | 1.82 | 2.56 |
| Dependability 50% | $Mm^3/yr$ | 4.68 | 3.23 | 4.54 | 3.18 | 4.47 | 3.15 | 4.42 |
| Dependability 25% | $Mm^3/yr$ | 21.03 | 14.66 | 20.54 | 14.10 | 19.76 | 13.56 | 19.00 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| Dependability 90% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| Dependability 75% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| Dependability 50% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| Dependability 25% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 9.02 | 6.31 | 8.80 | 6.11 | 8.51 | 5.92 | 8.24 |
| Dependability 90% | $Mm^3/yr$ | 0.88 | 0.58 | 0.78 | 0.55 | 0.73 | 0.53 | 0.70 |
| Dependability 75% | $Mm^3/yr$ | 2.89 | 2.01 | 2.79 | 1.99 | 2.74 | 1.97 | 2.71 |
| Dependability 50% | $Mm^3/yr$ | 4.76 | 3.35 | 4.66 | 3.32 | 4.61 | 3.31 | 4.58 |
| Dependability 25% | $Mm^3/yr$ | 21.11 | 14.78 | 20.65 | 14.24 | 19.90 | 13.72 | 19.15 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 10.62 | 7.44 | 9.93 | 7.00 | 9.41 | 6.65 | 8.97 |
| Dependability 90% | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| Dependability 75% | $Mm^3/yr$ | 4.49 | 3.14 | 3.92 | 2.88 | 3.64 | 2.70 | 3.44 |
| Dependability 50% | $Mm^3/yr$ | 6.36 | 4.48 | 5.79 | 4.21 | 5.50 | 4.04 | 5.31 |
| Dependability 25% | $Mm^3/yr$ | 22.71 | 15.91 | 21.78 | 15.13 | 20.79 | 14.45 | 19.88 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 10.62 | 7.44 | 9.93 | 7.00 | 9.41 | 6.65 | 8.97 |
| Dependability 90% | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| Dependability 75% | $Mm^3/yr$ | 4.49 | 3.14 | 3.92 | 2.88 | 3.64 | 2.70 | 3.44 |
| Dependability 50% | $Mm^3/yr$ | 6.36 | 4.48 | 5.79 | 4.21 | 5.50 | 4.04 | 5.31 |
| Dependability 25% | $Mm^3/yr$ | 22.71 | 15.91 | 21.78 | 15.13 | 20.79 | 14.45 | 19.88 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 144 | 101 | 134 | 95 | 127 | 90 | 121 |
| | Dependability 90% | mm/yr | 34 | 23 | 26 | 19 | 22 | 17 | 19 |
| | Dependability 75% | mm/yr | 61 | 43 | 53 | 39 | 49 | 37 | 47 |
| | Dependability 50% | mm/yr | 86 | 61 | 78 | 57 | 74 | 55 | 72 |
| | Dependability 25% | mm/yr | 307 | 215 | 295 | 205 | 281 | 195 | 269 |
| Well Yield | | $10^3 m^3/yr$ | 32 | | | | | | |
| No. of Irrigation Wells | Existing | | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 | 1221 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 17.27 | 19.36 | 16.49 | 18.59 | 15.78 | 17.90 | 15.16 |
| | Dependability 90% | $Mm^3/yr$ | 2.74 | 2.18 | 2.17 | 1.91 | 1.88 | 1.73 | 1.69 |
| | Dependability 75% | $Mm^3/yr$ | 6.33 | 6.48 | 5.76 | 6.22 | 5.47 | 6.04 | 5.28 |
| | Dependability 50% | $Mm^3/yr$ | 9.67 | 10.49 | 9.10 | 10.22 | 8.81 | 10.04 | 8.61 |
| | Dependability 25% | $Mm^3/yr$ | 38.86 | 44.77 | 37.66 | 42.99 | 36.11 | 41.29 | 34.64 |
| Depth | ted Mean | mm/yr | 234 | 262 | 223 | 251 | 213 | 242 | 205 |
| | Dependability 90% | mm/yr | 37 | 29 | 29 | 26 | 25 | 23 | 23 |
| | Dependability 75% | mm/yr | 86 | 88 | 78 | 84 | 74 | 82 | 71 |
| | Dependability 50% | mm/yr | 131 | 142 | 123 | 138 | 119 | 136 | 116 |
| | Dependability 25% | mm/yr | 526 | 606 | 509 | 581 | 488 | 558 | 469 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11138 | | | | | | |
| | Total | Mill.Rs. | | 82.35 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 82.35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.48 | | | | | | |
| Average Annual Cost | Mill.Rs | 5.10 | 3.57 | 4.77 | 3.36 | 4.51 | 3.19 | 4.31 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 5.10 | 3.57 | 4.77 | 3.36 | 4.51 | 3.19 | 4.31 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 5.10 | 3.57 | 4.77 | 3.36 | 4.51 | 3.19 | 4.31 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.210 | 0.200 | 0.257 | 0.333 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Arwar Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Bhilwara |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.21 | 0.2 | 0.257 | 0.333 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| . | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 7394 | 7394 | 7394 | 7394 | 7394 | 7394 | 7394 |
| SW On-Farm Irrigation Efficiency | % | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 | 70.00 | 61.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 | 0.47 | 0.26 |
| Dependability 75% | $Mm^3/yr$ | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 | 3.34 | 1.84 |
| Dependability 50% | $Mm^3/yr$ | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 | 6.01 | 3.31 |
| Dependability 25% | $Mm^3/yr$ | 16.16 | 28.87 | 15.88 | 27.85 | 15.32 | 26.84 | 14.76 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| Dependability 75% | $Mm^3/yr$ | 4.49 | 3.14 | 3.92 | 2.88 | 3.64 | 2.70 | 3.44 |
| Dependability 50% | $Mm^3/yr$ | 6.36 | 4.48 | 5.79 | 4.21 | 5.50 | 4.04 | 5.31 |
| Dependability 25% | $Mm^3/yr$ | 22.71 | 15.91 | 21.78 | 15.13 | 20.79 | 14.45 | 19.88 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.48 | 1.71 | 1.91 | 1.44 | 1.63 | 1.26 | 1.43 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 | 39.45 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 | 7.89 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 80.81 | 97.19 | 72.97 | 112.49 | 84.20 | 128.28 | 95.79 |
| CMLP Irrig. Intensity Dependability 90% | % | 6.19 | 6.04 | 5.26 | 5.13 | 4.42 | 4.65 | 3.96 |
| Dependability 75% | % | 14.16 | 17.67 | 13.82 | 16.41 | 12.72 | 15.93 | 12.25 |
| Dependability 50% | % | 21.63 | 28.61 | 21.86 | 27.03 | 20.52 | 26.54 | 20.06 |
| Dependability 25% | % | 86.75 | 121.90 | 90.44 | 113.47 | 84.07 | 108.96 | 80.66 |
| Weighted Mean | % | 38.58 | 52.75 | 39.60 | 49.09 | 36.74 | 47.27 | 35.30 |
| CMLP GW Use Dependability 90% | % | 90.62 | 78.52 | 88.16 | 75.52 | 86.35 | 73.01 | 84.77 |
| Dependability 75% | % | 70.08 | 47.23 | 67.46 | 45.48 | 66.01 | 43.87 | 64.74 |
| Dependability 50% | % | 62.71 | 38.92 | 61.58 | 38.86 | 61.17 | 37.77 | 60.27 |
| Dependability 25% | % | 52.80 | 29.69 | 54.40 | 31.75 | 55.53 | 31.53 | 55.34 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 5.10 | 12.66 | 4.77 | 12.45 | 4.51 | 12.28 | 4.31 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 | 9.09 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 5.10 | 12.66 | 4.77 | 12.45 | 4.51 | 12.28 | 4.31 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 80.81 | 97.19 | 72.97 | 112.49 | 84.20 | 128.28 | 95.79 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 10.96 | 13.92 | 10.45 | 13.36 | 10.00 | 12.86 | 9.61 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 17.27 | 19.36 | 16.49 | 18.59 | 15.78 | 17.90 | 15.16 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 118.31 | 100.68 | 17.63 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 118.31 | 100.68 | 17.63 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 625.51 | 469.22 | 156.29 |
| 5. Total Project Costs | Mill.Rs. | | 77.83 | 29.03 | 48.80 |
| 6. Project Capital Costs | Mill.Rs. | | 56.13 | 0.00 | 56.13 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 77.83 | 29.03 | 48.80 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 56.13 | 0.00 | 56.13 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 547.67 | 440.18 | 107.49 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.66 | 0.29 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7591 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.38 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **2.92** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Badgaon Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | UDAIPUR | Name(s): | |
| Groundwater Potential Zone (PZ) | MAVLI,KAPASAN | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 398.22 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 28.93 | Code: | |
| Present Dead Storage, $Mm^3$ | 0.3 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.34 | 0.69 | 0.69 | 0.83 | 0.83 | 0.93 | 0.93 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.28 | 0.30 | 0.30 | 0.34 | 0.34 | 0.38 | 0.38 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 6,797 | 6,797 | 6,797 | 6,797 | 6,797 | 6,797 | 6,797 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 7.62 | | | | | | |
| 2010 Irrigated Area | | ha | 1625 | | | | | | |

### III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 25.30 | 25.30 | 25.30 | 25.30 | 25.30 | 25.30 | 25.30 |
| Dependability 90% | $Mm^3/yr$ | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Dependability 75% | $Mm^3/yr$ | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Dependability 50% | $Mm^3/yr$ | 3.80 | 3.80 | 3.80 | 3.80 | 3.80 | 3.80 | 3.80 |
| Dependability 25% | $Mm^3/yr$ | 12.10 | 12.10 | 12.10 | 12.10 | 12.10 | 12.10 | 12.10 |
| Weighted Mean | $Mm^3/yr$ | 4.97 | 4.97 | 4.97 | 10.00 | 4.97 | 4.97 | 4.97 |
| Losses from Reservoir Annual | % | 14.85 | | | | | | |
| During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.05 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.52 | 0.52 | 1.57 | 1.57 | 2.61 | 2.61 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 28.93 | 28.64 | 28.64 | 27.66 | 27.66 | 26.62 | 26.62 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 4.61 | 4.61 | 4.61 | 4.61 | 4.61 | 4.61 | 4.61 |
| Dependability 90% | $Mm^3/yr$ | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 |
| Dependability 75% | $Mm^3/yr$ | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Dependability 50% | $Mm^3/yr$ | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 |
| Dependability 25% | $Mm^3/yr$ | 11.22 | 11.22 | 11.22 | 11.22 | 11.22 | 11.22 | 11.22 |
| On-Farm Irrigation Efficiency | % | 54.00 | 70.00 | 54.00 | 70.00 | 54.00 | 70.00 | 54.00 |
| Off-Farm Irrigation Efficiency | % | 47.87 | 72.00 | 47.87 | 72.00 | 47.87 | 72.00 | 47.87 |
| Present Overall Irrigation Efficiency | % | 25.85 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 2.21 | 3.32 | 2.21 | 3.32 | 2.21 | 3.32 | 2.21 |
| Dependability 90% | $Mm^3/yr$ | 0.09 | 0.13 | 0.09 | 0.13 | 0.09 | 0.13 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.44 | 0.67 | 0.44 | 0.67 | 0.44 | 0.67 | 0.44 |
| Dependability 50% | $Mm^3/yr$ | 1.69 | 2.54 | 1.69 | 2.54 | 1.69 | 2.54 | 1.69 |
| Dependability 25% | $Mm^3/yr$ | 5.37 | 8.08 | 5.37 | 8.08 | 5.37 | 8.08 | 5.37 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 32 | 49 | 32 | 49 | 32 | 49 | 32 |
| Dependability 90% | mm/yr | 1 | 2 | 1 | 2 | 1 | 2 | 1 |
| Dependability 75% | mm/yr | 7 | 10 | 7 | 10 | 7 | 10 | 7 |
| Dependability 50% | mm/yr | 25 | 37 | 25 | 37 | 25 | 37 | 25 |
| Dependability 25% | mm/yr | 79 | 119 | 79 | 119 | 79 | 119 | 79 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.81 | 2.81 | 2.81 | 2.81 | 2.81 | 2.81 | 2.81 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 51.91 | | 51.91 | | 51.91 | | 51.91 |
| Weighted Mean | $Mm^3/yr$ | 2.39 | 1.66 | 2.39 | 1.66 | 2.39 | 1.66 | 2.39 |
| Dependability 90% | $Mm^3/yr$ | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 | 0.07 | 0.10 |
| Dependability 75% | $Mm^3/yr$ | 0.48 | 0.33 | 0.48 | 0.33 | 0.48 | 0.33 | 0.48 |
| Dependability 50% | $Mm^3/yr$ | 1.83 | 1.27 | 1.83 | 1.27 | 1.83 | 1.27 | 1.83 |
| Dependability 25% | $Mm^3/yr$ | 5.82 | 4.04 | 5.82 | 4.04 | 5.82 | 4.04 | 5.82 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.40 | 0.19 | 0.29 | 0.15 | 0.23 | 0.13 | 0.19 |
| Dependability 90% | $Mm^3/yr$ | 0.40 | 0.19 | 0.29 | 0.15 | 0.23 | 0.13 | 0.19 |
| Dependability 75% | $Mm^3/yr$ | 0.40 | 0.19 | 0.29 | 0.15 | 0.23 | 0.13 | 0.19 |
| Dependability 50% | $Mm^3/yr$ | 0.40 | 0.19 | 0.29 | 0.15 | 0.23 | 0.13 | 0.19 |
| Dependability 25% | $Mm^3/yr$ | 0.40 | 0.19 | 0.29 | 0.15 | 0.23 | 0.13 | 0.19 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 2.79 | 1.85 | 2.68 | 1.81 | 2.62 | 1.79 | 2.58 |
| Dependability 90% | $Mm^3/yr$ | 0.49 | 0.26 | 0.38 | 0.22 | 0.33 | 0.19 | 0.29 |
| Dependability 75% | $Mm^3/yr$ | 0.88 | 0.52 | 0.77 | 0.49 | 0.71 | 0.46 | 0.67 |
| Dependability 50% | $Mm^3/yr$ | 2.23 | 1.46 | 2.11 | 1.42 | 2.06 | 1.39 | 2.02 |
| Dependability 25% | $Mm^3/yr$ | 6.22 | 4.23 | 6.11 | 4.19 | 6.06 | 4.17 | 6.01 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.06 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 90% | $Mm^3/yr$ | 0.06 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 75% | $Mm^3/yr$ | 0.06 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 50% | $Mm^3/yr$ | 0.06 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 25% | $Mm^3/yr$ | 0.06 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 2.85 | 1.94 | 2.77 | 1.92 | 2.73 | 1.91 | 2.70 |
| Dependability 90% | $Mm^3/yr$ | 0.55 | 0.35 | 0.47 | 0.33 | 0.43 | 0.31 | 0.40 |
| Dependability 75% | $Mm^3/yr$ | 0.93 | 0.61 | 0.86 | 0.59 | 0.82 | 0.58 | 0.79 |
| Dependability 50% | $Mm^3/yr$ | 2.28 | 1.55 | 2.20 | 1.53 | 2.17 | 1.51 | 2.14 |
| Dependability 25% | $Mm^3/yr$ | 6.28 | 4.32 | 6.20 | 4.30 | 6.16 | 4.28 | 6.13 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 4.17 | 2.89 | 3.72 | 2.69 | 3.50 | 2.54 | 3.33 |
| Dependability 90% | $Mm^3/yr$ | 1.87 | 1.30 | 1.42 | 1.10 | 1.20 | 0.94 | 1.03 |
| Dependability 75% | $Mm^3/yr$ | 2.25 | 1.56 | 1.81 | 1.36 | 1.59 | 1.21 | 1.42 |
| Dependability 50% | $Mm^3/yr$ | 3.60 | 2.50 | 3.15 | 2.30 | 2.94 | 2.14 | 2.77 |
| Dependability 25% | $Mm^3/yr$ | 7.60 | 5.27 | 7.15 | 5.07 | 6.93 | 4.91 | 6.76 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 4.17 | 2.89 | 3.72 | 2.69 | 3.50 | 2.54 | 3.33 |
| Dependability 90% | $Mm^3/yr$ | 1.87 | 1.30 | 1.42 | 1.10 | 1.20 | 0.94 | 1.03 |
| Dependability 75% | $Mm^3/yr$ | 2.25 | 1.56 | 1.81 | 1.36 | 1.59 | 1.21 | 1.42 |
| Dependability 50% | $Mm^3/yr$ | 3.60 | 2.50 | 3.15 | 2.30 | 2.94 | 2.14 | 2.77 |
| Dependability 25% | $Mm^3/yr$ | 7.60 | 5.27 | 7.15 | 5.07 | 6.93 | 4.91 | 6.76 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 61 | 43 | 55 | 40 | 52 | 37 | 49 |
| | Dependability 90% | mm/yr | 27 | 19 | 21 | 16 | 18 | 14 | 15 |
| | Dependability 75% | mm/yr | 33 | 23 | 27 | 20 | 23 | 18 | 21 |
| | Dependability 50% | mm/yr | 53 | 37 | 46 | 34 | 43 | 32 | 41 |
| | Dependability 25% | mm/yr | 112 | 78 | 105 | 75 | 102 | 72 | 99 |
| Well Yield | | $10^3 m^3/yr$ | 16 | | | | | | |
| No. of Irrigation Wells | Existing | | 1274 | 1274 | 1274 | 1274 | 1274 | 1274 | 1274 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 20.85 | 20.85 | 20.85 | 20.85 | 20.85 | 20.85 | 20.85 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 4.17 | 4.17 | 4.17 | 4.17 | 4.17 | 4.17 | 4.17 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 6.37 | 6.21 | 5.93 | 6.01 | 5.71 | 5.86 | 5.54 |
| | Dependability 90% | $Mm^3/yr$ | 1.96 | 1.43 | 1.51 | 1.23 | 1.29 | 1.08 | 1.12 |
| | Dependability 75% | $Mm^3/yr$ | 2.70 | 2.23 | 2.25 | 2.03 | 2.03 | 1.88 | 1.86 |
| | Dependability 50% | $Mm^3/yr$ | 5.29 | 5.04 | 4.84 | 4.84 | 4.62 | 4.68 | 4.45 |
| | Dependability 25% | $Mm^3/yr$ | 12.97 | 13.35 | 12.52 | 13.15 | 12.30 | 12.99 | 12.13 |
| Depth | ted Mean | mm/yr | 94 | 91 | 87 | 88 | 84 | 86 | 82 |
| | Dependability 90% | mm/yr | 29 | 21 | 22 | 18 | 19 | 16 | 17 |
| | Dependability 75% | mm/yr | 40 | 33 | 33 | 30 | 30 | 28 | 27 |
| | Dependability 50% | mm/yr | 78 | 74 | 71 | 71 | 68 | 69 | 66 |
| | Dependability 25% | mm/yr | 191 | 196 | 184 | 193 | 181 | 191 | 179 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/I$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 10353 | | | | | | |
| | Total | Mill.Rs. | | 70.37 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 70.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.57 | | | | | | |
| Average Annual Cost | Mill.Rs | 2.37 | 1.65 | 2.12 | 1.53 | 2.00 | 1.45 | 1.90 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 2.37 | 1.65 | 2.12 | 1.53 | 2.00 | 1.45 | 1.90 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 2.37 | 1.65 | 2.12 | 1.53 | 2.00 | 1.45 | 1.90 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.210 | 0.230 | 0.250 | 0.310 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Badgaon Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | UDAIPUR |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.21 | 0.23 | 0.25 | 0.31 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| . | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 6797 | 6797 | 6797 | 6797 | 6797 | 6797 | 6797 |
| SW On-Farm Irrigation Efficiency | % | 54.00 | 70.00 | 54.00 | 70.00 | 54.00 | 70.00 | 54.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.09 | 0.13 | 0.09 | 0.13 | 0.09 | 0.13 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.44 | 0.67 | 0.44 | 0.67 | 0.44 | 0.67 | 0.44 |
| Dependability 50% | $Mm^3/yr$ | 1.69 | 2.54 | 1.69 | 2.54 | 1.69 | 2.54 | 1.69 |
| Dependability 25% | $Mm^3/yr$ | 5.37 | 8.08 | 5.37 | 8.08 | 5.37 | 8.08 | 5.37 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.87 | 1.30 | 1.42 | 1.10 | 1.20 | 0.94 | 1.03 |
| Dependability 75% | $Mm^3/yr$ | 2.25 | 1.56 | 1.81 | 1.36 | 1.59 | 1.21 | 1.42 |
| Dependability 50% | $Mm^3/yr$ | 3.60 | 2.50 | 3.15 | 2.30 | 2.94 | 2.14 | 2.77 |
| Dependability 25% | $Mm^3/yr$ | 7.60 | 5.27 | 7.15 | 5.07 | 6.93 | 4.91 | 6.76 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.87 | 1.30 | 1.42 | 1.10 | 1.20 | 0.94 | 1.03 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 20.85 | 20.85 | 20.85 | 20.85 | 20.85 | 20.85 | 20.85 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 4.17 | 4.17 | 4.17 | 4.17 | 4.17 | 4.17 | 4.17 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 30.65 | 33.75 | 27.12 | 36.96 | 29.51 | 41.42 | 32.91 |
| CMLP Irrig. Intensity Dependability 90% | % | 6.68 | 5.64 | 5.14 | 4.66 | 4.22 | 3.95 | 3.56 |
| Dependability 75% | % | 9.04 | 8.70 | 7.50 | 7.59 | 6.48 | 6.80 | 5.75 |
| Dependability 50% | % | 17.32 | 19.44 | 15.77 | 17.90 | 14.42 | 16.83 | 13.48 |
| Dependability 25% | % | 41.87 | 51.32 | 40.32 | 48.48 | 37.96 | 46.59 | 36.39 |
| Weighted Mean | % | 20.79 | 23.96 | 19.25 | 22.23 | 17.75 | 21.05 | 16.72 |
| CMLP GW Use Dependability 90% | % | 95.46 | 90.67 | 94.12 | 89.15 | 93.13 | 87.58 | 92.10 |
| Dependability 75% | % | 83.39 | 69.27 | 79.98 | 66.23 | 77.78 | 63.73 | 75.86 |
| Dependability 50% | % | 65.65 | 44.58 | 62.34 | 42.47 | 60.63 | 42.17 | 60.04 |
| Dependability 25% | % | 54.13 | 31.68 | 52.43 | 30.99 | 51.78 | 32.84 | 51.57 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 7.76 | 0.00 | 7.76 | 0.00 | 7.76 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 2.37 | 9.41 | 2.12 | 9.30 | 2.00 | 9.21 | 1.90 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 7.76 | 0.00 | 7.76 | 0.00 | 7.76 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 2.37 | 9.41 | 2.12 | 9.30 | 2.00 | 9.21 | 1.90 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 30.65 | 33.75 | 27.12 | 36.96 | 29.51 | 41.42 | 32.91 |
| Wtd.Mean net Irrigation water supply | $Mm^3$/yr | 3.90 | 4.49 | 3.61 | 4.34 | 3.47 | 4.23 | 3.36 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3$/yr | 6.37 | 6.21 | 5.93 | 6.01 | 5.71 | 5.86 | 5.54 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3$/yr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 38.04 | 36.26 | 1.78 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 38.04 | 36.26 | 1.78 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 213.96 | 171.61 | 42.36 |
| 5. Total Project Costs | Mill.Rs. | | 57.95 | 12.90 | 45.06 |
| 6. Project Capital Costs | Mill.Rs. | | 47.96 | 0.00 | 47.96 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 57.95 | 12.90 | 45.06 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 47.96 | 0.00 | 47.96 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 156.01 | 158.71 | -2.70 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.52 | 0.36 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7056 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.95 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.94** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Bagolia Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Udaipur | Name(s): | |
| Groundwater Potential Zone (PZ) | Mavali | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 246 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 17.68 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.23 | 0.49 | 0.49 | 0.62 | 0.62 | 0.72 | 0.72 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.19 | 0.20 | 0.20 | 0.22 | 0.22 | 0.25 | 0.25 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,676 | 3,676 | 3,676 | 3,676 | 3,676 | 3,676 | 3,676 |
| 1995Irrigation (Gross) | | $Mm^3/yr$ | 1.57 | | | | | | |
| 1995Irrigated Area | | ha | 26 | | | | | | |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| | Dependability 25% | $Mm^3/yr$ | 1.11 | 1.11 | 1.11 | 1.11 | 1.11 | 1.11 | 1.11 |
| | Weighted Mean | $Mm^3/yr$ | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 |
| Losses from Reservoir | Annual | % | 14.85 | | | | | | |
| | During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.03 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.32 | 0.32 | 0.97 | 0.97 | 1.61 | 1.61 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 17.68 | 17.36 | 17.36 | 16.71 | 16.71 | 16.07 | 16.07 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 |
| Dependability 25% | $Mm^3/yr$ | 1.03 | 1.03 | 1.03 | 1.03 | 1.03 | 1.03 | 1.03 |
| On-Farm Irrigation Efficiency | % | 40.14 | 70.00 | 40.14 | 70.00 | 40.14 | 70.00 | 40.14 |
| Off-Farm Irrigation Efficiency | % | 29.00 | 72.00 | 29.00 | 72.00 | 29.00 | 72.00 | 29.00 |
| Present Overall Irrigation Efficiency | % | 11.64 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 0.12 | 0.29 | 0.12 | 0.29 | 0.12 | 0.29 | 0.12 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.05 | 0.13 | 0.05 | 0.13 | 0.05 | 0.13 | 0.05 |
| Dependability 25% | $Mm^3/yr$ | 0.30 | 0.74 | 0.30 | 0.74 | 0.30 | 0.74 | 0.30 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 3 | 8 | 3 | 8 | 3 | 8 | 3 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 50% | mm/yr | 1 | 4 | 1 | 4 | 1 | 4 | 1 |
| Dependability 25% | mm/yr | 8 | 20 | 8 | 20 | 8 | 20 | 8 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 61.85 | | 61.85 | | 61.85 | | 61.85 |
| Weighted Mean | $Mm^3/yr$ | 0.25 | 0.15 | 0.25 | 0.15 | 0.25 | 0.15 | 0.25 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.11 | 0.07 | 0.11 | 0.07 | 0.11 | 0.07 | 0.11 |
| Dependability 25% | $Mm^3/yr$ | 0.64 | 0.37 | 0.64 | 0.37 | 0.64 | 0.37 | 0.64 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.19 | 0.07 | 0.11 | 0.04 | 0.07 | 0.02 | 0.03 |
| Dependability 90% | $Mm^3/yr$ | 0.19 | 0.07 | 0.11 | 0.04 | 0.07 | 0.02 | 0.03 |
| Dependability 75% | $Mm^3/yr$ | 0.19 | 0.07 | 0.11 | 0.04 | 0.07 | 0.02 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.19 | 0.07 | 0.11 | 0.04 | 0.07 | 0.02 | 0.03 |
| Dependability 25% | $Mm^3/yr$ | 0.19 | 0.07 | 0.11 | 0.04 | 0.07 | 0.02 | 0.03 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 0.44 | 0.22 | 0.36 | 0.19 | 0.32 | 0.17 | 0.28 |
| Dependability 90% | $Mm^3/yr$ | 0.19 | 0.07 | 0.11 | 0.04 | 0.07 | 0.02 | 0.03 |
| Dependability 75% | $Mm^3/yr$ | 0.19 | 0.07 | 0.11 | 0.04 | 0.07 | 0.02 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.31 | 0.14 | 0.23 | 0.11 | 0.18 | 0.09 | 0.14 |
| Dependability 25% | $Mm^3/yr$ | 0.83 | 0.44 | 0.75 | 0.41 | 0.70 | 0.39 | 0.66 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.04 | 0.06 | 0.06 | 0.08 | 0.08 | 0.09 | 0.09 |
| Dependability 90% | $Mm^3/yr$ | 0.04 | 0.06 | 0.06 | 0.08 | 0.08 | 0.09 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.04 | 0.06 | 0.06 | 0.08 | 0.08 | 0.09 | 0.09 |
| Dependability 50% | $Mm^3/yr$ | 0.04 | 0.06 | 0.06 | 0.08 | 0.08 | 0.09 | 0.09 |
| Dependability 25% | $Mm^3/yr$ | 0.04 | 0.06 | 0.06 | 0.08 | 0.08 | 0.09 | 0.09 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 0.48 | 0.28 | 0.43 | 0.27 | 0.39 | 0.25 | 0.37 |
| Dependability 90% | $Mm^3/yr$ | 0.23 | 0.14 | 0.17 | 0.12 | 0.14 | 0.11 | 0.12 |
| Dependability 75% | $Mm^3/yr$ | 0.23 | 0.14 | 0.17 | 0.12 | 0.14 | 0.11 | 0.12 |
| Dependability 50% | $Mm^3/yr$ | 0.34 | 0.20 | 0.29 | 0.19 | 0.26 | 0.17 | 0.23 |
| Dependability 25% | $Mm^3/yr$ | 0.87 | 0.51 | 0.81 | 0.49 | 0.78 | 0.48 | 0.75 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 1.12 | 0.65 | 0.80 | 0.49 | 0.61 | 0.35 | 0.46 |
| Dependability 90% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| Dependability 50% | $Mm^3/yr$ | 0.98 | 0.57 | 0.66 | 0.41 | 0.48 | 0.27 | 0.32 |
| Dependability 25% | $Mm^3/yr$ | 1.51 | 0.88 | 1.18 | 0.71 | 1.00 | 0.57 | 0.84 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 1.12 | 0.65 | 0.80 | 0.49 | 0.61 | 0.35 | 0.46 |
| Dependability 90% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| Dependability 50% | $Mm^3/yr$ | 0.98 | 0.57 | 0.66 | 0.41 | 0.48 | 0.27 | 0.32 |
| Dependability 25% | $Mm^3/yr$ | 1.51 | 0.88 | 1.18 | 0.71 | 1.00 | 0.57 | 0.84 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 31 | 18 | 22 | 13 | 17 | 9 | 13 |
| | Dependability 90% | mm/yr | 24 | 14 | 15 | 9 | 10 | 5 | 6 |
| | Dependability 75% | mm/yr | 24 | 14 | 15 | 9 | 10 | 5 | 6 |
| | Dependability 50% | mm/yr | 27 | 16 | 18 | 11 | 13 | 7 | 9 |
| | Dependability 25% | mm/yr | 41 | 24 | 32 | 19 | 27 | 15 | 23 |
| Well Yield | | $10^3 m^3/yr$ | 9 | | | | | | |
| No. of Irrigation Wells | Existing | | 530 | 530 | 530 | 530 | 530 | 530 | 530 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 4.83 | 4.83 | 4.83 | 4.83 | 4.83 | 4.83 | 4.83 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 1.24 | 0.95 | 0.91 | 0.78 | 0.73 | 0.64 | 0.58 |
| | Dependability 90% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| | Dependability 75% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| | Dependability 50% | $Mm^3/yr$ | 1.04 | 0.71 | 0.71 | 0.54 | 0.53 | 0.40 | 0.38 |
| | Dependability 25% | $Mm^3/yr$ | 1.81 | 1.62 | 1.48 | 1.45 | 1.30 | 1.31 | 1.14 |
| Depth | ted Mean | mm/yr | 34 | 26 | 25 | 21 | 20 | 17 | 16 |
| | Dependability 90% | mm/yr | 24 | 14 | 15 | 9 | 10 | 5 | 6 |
| | Dependability 75% | mm/yr | 24 | 14 | 15 | 9 | 10 | 5 | 6 |
| | Dependability 50% | mm/yr | 28 | 19 | 19 | 15 | 14 | 11 | 10 |
| | Dependability 25% | mm/yr | 49 | 44 | 40 | 40 | 35 | 36 | 31 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11285 | | | | | | |
| | Total | Mill.Rs. | | 41.48 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 41.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.55 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.62 | 0.36 | 0.44 | 0.27 | 0.34 | 0.19 | 0.25 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 0.62 | 0.36 | 0.44 | 0.27 | 0.34 | 0.19 | 0.25 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 0.62 | 0.36 | 0.44 | 0.27 | 0.34 | 0.19 | 0.25 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.179 | 0.257 | 0.205 | 0.359 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | BagoliaIrrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Udaipur |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.179 | 0.257 | 0.205 | 0.359 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| . | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3676 | 3676 | 3676 | 3676 | 3676 | 3676 | 3676 |
| SW On-Farm Irrigation Efficiency | % | 40.14 | 70.00 | 40.14 | 70.00 | 40.14 | 70.00 | 40.14 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.05 | 0.13 | 0.05 | 0.13 | 0.05 | 0.13 | 0.05 |
| Dependability 25% | $Mm^3/yr$ | 0.30 | 0.74 | 0.30 | 0.74 | 0.30 | 0.74 | 0.30 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| Dependability 50% | $Mm^3/yr$ | 0.98 | 0.57 | 0.66 | 0.41 | 0.48 | 0.27 | 0.32 |
| Dependability 25% | $Mm^3/yr$ | 1.51 | 0.88 | 1.18 | 0.71 | 1.00 | 0.57 | 0.84 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.87 | 0.51 | 0.54 | 0.34 | 0.36 | 0.20 | 0.21 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 4.83 | 4.83 | 4.83 | 4.83 | 4.83 | 4.83 | 4.83 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 6.10 | 5.22 | 4.24 | 4.86 | 3.80 | 4.55 | 3.39 |
| CMLP Irrig. Intensity Dependability 90% | % | 5.53 | 3.72 | 3.46 | 2.40 | 2.21 | 1.36 | 1.23 |
| Dependability 75% | % | 5.55 | 3.73 | 3.47 | 2.40 | 2.22 | 1.36 | 1.24 |
| Dependability 50% | % | 6.52 | 5.16 | 4.43 | 3.77 | 3.14 | 2.69 | 2.13 |
| Dependability 25% | % | 10.86 | 11.62 | 8.76 | 10.02 | 7.29 | 8.72 | 6.17 |
| Weighted Mean | % | 7.65 | 6.85 | 5.56 | 5.42 | 4.23 | 4.28 | 3.19 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 50% | % | 94.14 | 80.16 | 91.47 | 73.65 | 90.74 | 64.62 | 84.52 |
| Dependability 25% | % | 83.50 | 48.70 | 76.76 | 42.89 | 76.03 | 38.99 | 72.96 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.58 | 0.00 | 4.58 | 0.00 | 4.58 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 0.62 | 4.94 | 0.44 | 4.85 | 0.34 | 4.77 | 0.25 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.58 | 0.00 | 4.58 | 0.00 | 4.58 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 0.62 | 4.94 | 0.44 | 4.85 | 0.34 | 4.77 | 0.25 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 6.10 | 5.22 | 4.24 | 4.86 | 3.80 | 4.55 | 3.39 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 0.78 | 0.70 | 0.56 | 0.57 | 0.45 | 0.46 | 0.35 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 1.24 | 0.95 | 0.91 | 0.78 | 0.73 | 0.64 | 0.58 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 5.58 | 5.35 | 0.23 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 5.58 | 5.35 | 0.23 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 31.66 | 25.47 | 6.20 |
| 5. Total Project Costs | Mill.Rs. | | 30.34 | 2.54 | 27.80 |
| 6. Project Capital Costs | Mill.Rs. | | 28.27 | 0.00 | 28.27 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 30.34 | 2.54 | 27.80 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 28.27 | 0.00 | 28.27 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 1.32 | 22.92 | -21.60 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 5.44 | 0.47 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7691 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.29 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.24** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Bassi Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Chittor | Name(s): | |
| Groundwater Potential Zone (PZ) | Begum,Chittor,Gangar | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 122 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 20.07 | Code: | |
| Present Dead Storage, $Mm^3$ | 2.72 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.18 | 0.37 | 0.37 | 0.44 | 0.44 | 0.49 | 0.49 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.18 | 0.19 | 0.19 | 0.21 | 0.21 | 0.23 | 0.23 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 18.68 | | | | | | |
| 2010 Irrigated Area | | ha | 1120 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 56.44 | 56.44 | 56.44 | 56.44 | 56.44 | 56.44 | 56.44 |
| | Dependability 90% | $Mm^3/yr$ | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 |
| | Dependability 75% | $Mm^3/yr$ | 13.20 | 13.20 | 13.20 | 13.20 | 13.20 | 13.20 | 13.20 |
| | Dependability 50% | $Mm^3/yr$ | 37.40 | 37.40 | 37.40 | 37.40 | 37.40 | 37.40 | 37.40 |
| | Dependability 25% | $Mm^3/yr$ | 79.70 | 79.70 | 79.70 | 79.70 | 79.70 | 79.70 | 79.70 |
| | Weighted Mean | $Mm^3/yr$ | 37.24 | 37.24 | 37.24 | 37.24 | 37.24 | 37.24 | 37.24 |
| Losses from Reservoir | Annual | % | 18.93 | | | | | | |
| | During the Rabi Season | % | 9.10 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.02 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.16 | 0.16 | 0.48 | 0.48 | 0.80 | 0.80 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 20.07 | 19.98 | 19.98 | 19.81 | 19.81 | 19.63 | 19.63 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 13.13 | 13.08 | 13.08 | 12.99 | 12.99 | 12.90 | 12.90 |
| Dependability 90% | $Mm^3/yr$ | 1.64 | 1.64 | 1.64 | 1.64 | 1.64 | 1.64 | 1.64 |
| Dependability 75% | $Mm^3/yr$ | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 |
| Dependability 50% | $Mm^3/yr$ | 18.24 | 18.16 | 18.16 | 18.00 | 18.00 | 17.84 | 17.84 |
| Dependability 25% | $Mm^3/yr$ | 18.24 | 18.16 | 18.16 | 18.00 | 18.00 | 17.84 | 17.84 |
| On-Farm Irrigation Efficiency | % | 56.99 | 70.00 | 56.99 | 70.00 | 56.99 | 70.00 | 56.99 |
| Off-Farm Irrigation Efficiency | % | 26.32 | 72.00 | 26.32 | 72.00 | 26.32 | 72.00 | 26.32 |
| Present Overall Irrigation Efficiency | % | 15.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 3.46 | 9.42 | 3.44 | 9.35 | 3.42 | 9.29 | 3.40 |
| Dependability 90% | $Mm^3/yr$ | 0.43 | 1.18 | 0.43 | 1.18 | 0.43 | 1.18 | 0.43 |
| Dependability 75% | $Mm^3/yr$ | 3.16 | 8.64 | 3.16 | 8.64 | 3.16 | 8.64 | 3.16 |
| Dependability 50% | $Mm^3/yr$ | 4.80 | 13.08 | 4.78 | 12.96 | 4.74 | 12.85 | 4.70 |
| Dependability 25% | $Mm^3/yr$ | 4.80 | 13.08 | 4.78 | 12.96 | 4.74 | 12.85 | 4.70 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 106 | 290 | 106 | 288 | 105 | 286 | 104 |
| Dependability 90% | mm/yr | 13 | 36 | 13 | 36 | 13 | 36 | 13 |
| Dependability 75% | mm/yr | 97 | 266 | 97 | 266 | 97 | 266 | 97 |
| Dependability 50% | mm/yr | 148 | 402 | 147 | 399 | 146 | 395 | 145 |
| Dependability 25% | mm/yr | 148 | 402 | 147 | 399 | 146 | 395 | 145 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 4.56 | 4.54 | 4.54 | 4.50 | 4.50 | 4.46 | 4.46 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 22.80 | 22.85 | 22.85 | 22.95 | 22.95 | 23.05 | 23.05 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 17.33 | 17.42 | 17.42 | 17.59 | 17.59 | 17.77 | 17.77 |
| Dependability 25% | $Mm^3/yr$ | 59.63 | 59.72 | 59.72 | 59.89 | 59.89 | 60.07 | 60.07 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 59.50 | | 59.50 | | 59.50 | | 59.50 |
| Weighted Mean | $Mm^3/yr$ | 7.81 | 4.71 | 7.78 | 4.68 | 7.73 | 4.64 | 7.68 |
| Dependability 90% | $Mm^3/yr$ | 0.97 | 0.59 | 0.97 | 0.59 | 0.97 | 0.59 | 0.97 |
| Dependability 75% | $Mm^3/yr$ | 7.14 | 4.32 | 7.14 | 4.32 | 7.14 | 4.32 | 7.14 |
| Dependability 50% | $Mm^3/yr$ | 10.85 | 6.54 | 10.81 | 6.48 | 10.71 | 6.42 | 10.62 |
| Dependability 25% | $Mm^3/yr$ | 10.85 | 6.54 | 10.81 | 6.48 | 10.71 | 6.42 | 10.62 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.40 | 0.23 | 0.34 | 0.21 | 0.32 | 0.20 | 0.29 |
| Dependability 90% | $Mm^3/yr$ | 0.40 | 0.23 | 0.34 | 0.21 | 0.32 | 0.20 | 0.29 |
| Dependability 75% | $Mm^3/yr$ | 0.40 | 0.23 | 0.34 | 0.21 | 0.32 | 0.20 | 0.29 |
| Dependability 50% | $Mm^3/yr$ | 0.40 | 0.23 | 0.34 | 0.21 | 0.32 | 0.20 | 0.29 |
| Dependability 25% | $Mm^3/yr$ | 0.40 | 0.23 | 0.34 | 0.21 | 0.32 | 0.20 | 0.29 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 8.21 | 4.94 | 8.13 | 4.89 | 8.05 | 4.84 | 7.97 |
| Dependability 90% | $Mm^3/yr$ | 1.38 | 0.82 | 1.32 | 0.80 | 1.29 | 0.78 | 1.27 |
| Dependability 75% | $Mm^3/yr$ | 7.54 | 4.55 | 7.48 | 4.53 | 7.45 | 4.51 | 7.43 |
| Dependability 50% | $Mm^3/yr$ | 11.26 | 6.77 | 11.15 | 6.69 | 11.03 | 6.62 | 10.91 |
| Dependability 25% | $Mm^3/yr$ | 11.26 | 6.77 | 11.15 | 6.69 | 11.03 | 6.62 | 10.91 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 90% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 50% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 25% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 8.25 | 4.99 | 8.18 | 4.95 | 8.10 | 4.91 | 8.04 |
| Dependability 90% | $Mm^3/yr$ | 1.41 | 0.87 | 1.37 | 0.86 | 1.35 | 0.85 | 1.33 |
| Dependability 75% | $Mm^3/yr$ | 7.57 | 4.60 | 7.53 | 4.59 | 7.51 | 4.58 | 7.50 |
| Dependability 50% | $Mm^3/yr$ | 11.29 | 6.82 | 11.20 | 6.75 | 11.09 | 6.68 | 10.98 |
| Dependability 25% | $Mm^3/yr$ | 11.29 | 6.82 | 11.20 | 6.75 | 11.09 | 6.68 | 10.98 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 9.59 | 6.13 | 9.32 | 6.00 | 9.15 | 5.88 | 9.01 |
| Dependability 90% | $Mm^3/yr$ | 2.75 | 2.01 | 2.51 | 1.91 | 2.40 | 1.83 | 2.31 |
| Dependability 75% | $Mm^3/yr$ | 8.92 | 5.74 | 8.67 | 5.64 | 8.56 | 5.56 | 8.47 |
| Dependability 50% | $Mm^3/yr$ | 12.63 | 7.96 | 12.34 | 7.80 | 12.14 | 7.66 | 11.95 |
| Dependability 25% | $Mm^3/yr$ | 12.63 | 7.96 | 12.34 | 7.80 | 12.14 | 7.66 | 11.95 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 9.59 | 6.13 | 9.32 | 6.00 | 9.15 | 5.88 | 9.01 |
| Dependability 90% | $Mm^3/yr$ | 2.75 | 2.01 | 2.51 | 1.91 | 2.40 | 1.83 | 2.31 |
| Dependability 75% | $Mm^3/yr$ | 8.92 | 5.74 | 8.67 | 5.64 | 8.56 | 5.56 | 8.47 |
| Dependability 50% | $Mm^3/yr$ | 12.63 | 7.96 | 12.34 | 7.80 | 12.14 | 7.66 | 11.95 |
| Dependability 25% | $Mm^3/yr$ | 12.63 | 7.96 | 12.34 | 7.80 | 12.14 | 7.66 | 11.95 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 295 | 189 | 287 | 184 | 282 | 181 | 277 |
| | Dependability 90% | mm/yr | 85 | 62 | 77 | 59 | 74 | 56 | 71 |
| | Dependability 75% | mm/yr | 274 | 177 | 267 | 173 | 263 | 171 | 261 |
| | Dependability 50% | mm/yr | 389 | 245 | 380 | 240 | 373 | 236 | 368 |
| | Dependability 25% | mm/yr | 389 | 245 | 380 | 240 | 373 | 236 | 368 |
| Well Yield | | $10^3 m^3/yr$ | 19 | | | | | | |
| No. of Irrigation Wells | Existing | | 730 | 730 | 730 | 730 | 730 | 730 | 730 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 13.80 | 13.80 | 13.80 | 13.80 | 13.80 | 13.80 | 13.80 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 13.04 | 15.55 | 12.76 | 15.35 | 12.57 | 15.17 | 12.41 |
| | Dependability 90% | $Mm^3/yr$ | 3.18 | 3.19 | 2.94 | 3.09 | 2.83 | 3.00 | 2.74 |
| | Dependability 75% | $Mm^3/yr$ | 12.08 | 14.38 | 11.83 | 14.28 | 11.72 | 14.20 | 11.63 |
| | Dependability 50% | $Mm^3/yr$ | 17.44 | 21.04 | 17.12 | 20.76 | 16.88 | 20.51 | 16.65 |
| | Dependability 25% | $Mm^3/yr$ | 17.44 | 21.04 | 17.12 | 20.76 | 16.88 | 20.51 | 16.65 |
| Depth | ted Mean | mm/yr | 401 | 478 | 393 | 472 | 387 | 467 | 382 |
| | Dependability 90% | mm/yr | 98 | 98 | 90 | 95 | 87 | 92 | 84 |
| | Dependability 75% | mm/yr | 372 | 442 | 364 | 439 | 361 | 437 | 358 |
| | Dependability 50% | mm/yr | 536 | 647 | 527 | 639 | 519 | 631 | 512 |
| | Dependability 25% | mm/yr | 536 | 647 | 527 | 639 | 519 | 631 | 512 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9100 | | | | | | |
| | Total | Mill.Rs. | | 29.58 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 29.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.47 | | | | | | |
| Average Annual Cost | Mill.Rs | 4.51 | 2.88 | 4.38 | 2.82 | 4.30 | 2.76 | 4.24 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 4.51 | 2.88 | 4.38 | 2.82 | 4.30 | 2.76 | 4.24 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 4.51 | 2.88 | 4.38 | 2.82 | 4.30 | 2.76 | 4.24 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.231 | 0.205 | 0.256 | 0.308 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Bassi Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Chittor |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.231 | 0.205 | 0.256 | 0.308 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3250 | 3250 | 3250 | 3250 | 3250 | 3250 | 3250 |
| SW On-Farm Irrigation Efficiency | % | 56.99 | 70.00 | 56.99 | 70.00 | 56.99 | 70.00 | 56.99 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.43 | 1.18 | 0.43 | 1.18 | 0.43 | 1.18 | 0.43 |
| Dependability 75% | $Mm^3/yr$ | 3.16 | 8.64 | 3.16 | 8.64 | 3.16 | 8.64 | 3.16 |
| Dependability 50% | $Mm^3/yr$ | 4.80 | 13.08 | 4.78 | 12.96 | 4.74 | 12.85 | 4.70 |
| Dependability 25% | $Mm^3/yr$ | 4.80 | 13.08 | 4.78 | 12.96 | 4.74 | 12.85 | 4.70 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.75 | 2.01 | 2.51 | 1.91 | 2.40 | 1.83 | 2.31 |
| Dependability 75% | $Mm^3/yr$ | 8.92 | 5.74 | 8.67 | 5.64 | 8.56 | 5.56 | 8.47 |
| Dependability 50% | $Mm^3/yr$ | 12.63 | 7.96 | 12.34 | 7.80 | 12.14 | 7.66 | 11.95 |
| Dependability 25% | $Mm^3/yr$ | 12.63 | 7.96 | 12.34 | 7.80 | 12.14 | 7.66 | 11.95 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.75 | 2.01 | 2.51 | 1.91 | 2.40 | 1.83 | 2.31 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 13.80 | 13.80 | 13.80 | 13.80 | 13.80 | 13.80 | 13.80 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 52.52 | 71.30 | 53.00 | 83.41 | 61.32 | 94.22 | 68.77 |
| CMLP Irrig. Intensity Dependability 90% | % | 19.05 | 22.11 | 17.78 | 21.24 | 16.96 | 20.66 | 16.42 |
| Dependability 75% | % | 71.32 | 98.42 | 70.70 | 97.01 | 69.54 | 96.43 | 68.99 |
| Dependability 50% | % | 103.25 | 136.99 | 102.64 | 136.99 | 100.42 | 136.99 | 99.06 |
| Dependability 25% | % | 103.58 | 136.99 | 102.99 | 136.99 | 100.75 | 136.99 | 99.38 |
| Weighted Mean | % | 77.35 | 102.54 | 76.60 | 102.05 | 74.91 | 101.80 | 73.90 |
| CMLP GW Use Dependability 90% | % | 86.47 | 63.02 | 85.34 | 61.83 | 84.75 | 60.78 | 84.25 |
| Dependability 75% | % | 73.32 | 38.24 | 72.80 | 37.82 | 72.55 | 37.46 | 72.33 |
| Dependability 50% | % | 70.71 | 33.89 | 69.17 | 33.00 | 69.02 | 32.22 | 70.13 |
| Dependability 25% | % | 70.37 | 32.96 | 68.66 | 32.05 | 68.51 | 31.24 | 69.83 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.26 | 0.00 | 3.26 | 0.00 | 3.26 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 4.51 | 6.14 | 4.38 | 6.08 | 4.30 | 6.03 | 4.24 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.26 | 0.00 | 3.26 | 0.00 | 3.26 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 4.51 | 6.14 | 4.38 | 6.08 | 4.30 | 6.03 | 4.24 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 52.52 | 71.30 | 53.00 | 83.41 | 61.32 | 94.22 | 68.77 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 8.20 | 11.19 | 8.02 | 11.05 | 7.90 | 10.91 | 7.79 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 13.04 | 15.55 | 12.76 | 15.35 | 12.57 | 15.17 | 12.41 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 95.71 | 78.51 | 17.20 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 95.71 | 78.51 | 17.20 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 460.02 | 340.83 | 119.18 |
| 5. Total Project Costs | Mill.Rs. | | 37.85 | 26.92 | 10.92 |
| 6. Project Capital Costs | Mill.Rs. | | 20.16 | 0.00 | 20.16 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 37.85 | 26.92 | 10.92 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 20.16 | 0.00 | 20.16 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 422.17 | 313.91 | 108.26 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.40 | 0.34 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6202 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 3.86 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **6.37** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Bhupal Sagar Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | CHITTORGARH | Name(s): | |
| Groundwater Potential Zone (PZ) | KAPASON | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 176.4 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 16.83 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.16 | 0.33 | 0.33 | 0.39 | 0.39 | 0.43 | 0.43 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.12 | 0.12 | 0.12 | 0.14 | 0.14 | 0.16 | 0.16 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,873 | 3,873 | 3,873 | 3,873 | 3,873 | 3,873 | 3,873 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 3.96 | | | | | | |
| 2010 Irrigated Area | | ha | 995 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 9.38 | 9.38 | 9.38 | 9.38 | 9.38 | 9.38 | 9.38 |
| | Dependability 90% | $Mm^3/yr$ | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| | Dependability 75% | $Mm^3/yr$ | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Dependability 50% | $Mm^3/yr$ | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 |
| | Dependability 25% | $Mm^3/yr$ | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 |
| | Weighted Mean | $Mm^3/yr$ | 4.29 | 4.29 | 4.29 | 4.29 | 4.29 | 4.29 | 4.29 |
| Losses from Reservoir | Annual | % | 14.50 | | | | | | |
| | During the Rabi Season | % | 7.28 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.02 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.23 | 0.23 | 0.69 | 0.69 | 1.16 | 1.16 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 16.83 | 16.60 | 16.60 | 16.14 | 16.14 | 15.67 | 15.67 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 3.98 | 3.98 | 3.98 | 3.98 | 3.98 | 3.98 | 3.98 |
| Dependability 90% | $Mm^3/yr$ | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Dependability 50% | $Mm^3/yr$ | 4.08 | 4.08 | 4.08 | 4.08 | 4.08 | 4.08 | 4.08 |
| Dependability 25% | $Mm^3/yr$ | 7.05 | 7.05 | 7.05 | 7.05 | 7.05 | 7.05 | 7.05 |
| On-Farm Irrigation Efficiency | % | 75.02 | 75.00 | 75.02 | 75.00 | 75.02 | 75.00 | 75.02 |
| Off-Farm Irrigation Efficiency | % | 50.00 | 72.00 | 50.00 | 72.00 | 50.00 | 72.00 | 50.00 |
| Present Overall Irrigation Efficiency | % | 37.51 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 1.99 | 2.86 | 1.99 | 2.86 | 1.99 | 2.86 | 1.99 |
| Dependability 90% | $Mm^3/yr$ | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.46 | 0.67 | 0.46 | 0.67 | 0.46 | 0.67 | 0.46 |
| Dependability 50% | $Mm^3/yr$ | 2.04 | 2.94 | 2.04 | 2.94 | 2.04 | 2.94 | 2.04 |
| Dependability 25% | $Mm^3/yr$ | 3.52 | 5.07 | 3.52 | 5.07 | 3.52 | 5.07 | 3.52 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 51 | 74 | 51 | 74 | 51 | 74 | 51 |
| Dependability 90% | mm/yr | 1 | 2 | 1 | 2 | 1 | 2 | 1 |
| Dependability 75% | mm/yr | 12 | 17 | 12 | 17 | 12 | 17 | 12 |
| Dependability 50% | mm/yr | 53 | 76 | 53 | 76 | 53 | 76 | 53 |
| Dependability 25% | mm/yr | 91 | 131 | 91 | 131 | 91 | 131 | 91 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 1.76 | 1.76 | 1.76 | 1.76 | 1.76 | 1.76 | 1.76 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.31 | 1.31 | 1.31 | 1.31 | 1.31 | 1.31 | 1.31 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 43.74 | | 43.74 | | 43.74 | | 43.74 |
| Weighted Mean | $Mm^3/yr$ | 1.74 | 1.43 | 1.74 | 1.43 | 1.74 | 1.43 | 1.74 |
| Dependability 90% | $Mm^3/yr$ | 0.04 | 0.03 | 0.04 | 0.03 | 0.04 | 0.03 | 0.04 |
| Dependability 75% | $Mm^3/yr$ | 0.41 | 0.33 | 0.41 | 0.33 | 0.41 | 0.33 | 0.41 |
| Dependability 50% | $Mm^3/yr$ | 1.78 | 1.47 | 1.78 | 1.47 | 1.78 | 1.47 | 1.78 |
| Dependability 25% | $Mm^3/yr$ | 3.08 | 2.54 | 3.08 | 2.54 | 3.08 | 2.54 | 3.08 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.31 | 0.17 | 0.26 | 0.16 | 0.23 | 0.14 | 0.22 |
| Dependability 90% | $Mm^3/yr$ | 0.31 | 0.17 | 0.26 | 0.16 | 0.23 | 0.14 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 0.31 | 0.17 | 0.26 | 0.16 | 0.23 | 0.14 | 0.22 |
| Dependability 50% | $Mm^3/yr$ | 0.31 | 0.17 | 0.26 | 0.16 | 0.23 | 0.14 | 0.22 |
| Dependability 25% | $Mm^3/yr$ | 0.31 | 0.17 | 0.26 | 0.16 | 0.23 | 0.14 | 0.22 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 2.05 | 1.60 | 2.00 | 1.59 | 1.97 | 1.58 | 1.96 |
| Dependability 90% | $Mm^3/yr$ | 0.35 | 0.21 | 0.30 | 0.19 | 0.27 | 0.18 | 0.26 |
| Dependability 75% | $Mm^3/yr$ | 0.71 | 0.51 | 0.66 | 0.49 | 0.64 | 0.48 | 0.62 |
| Dependability 50% | $Mm^3/yr$ | 2.09 | 1.64 | 2.04 | 1.62 | 2.02 | 1.61 | 2.00 |
| Dependability 25% | $Mm^3/yr$ | 3.39 | 2.71 | 3.34 | 2.69 | 3.32 | 2.68 | 3.30 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 |
| Dependability 90% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 |
| Dependability 50% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 |
| Dependability 25% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 2.07 | 1.65 | 2.04 | 1.64 | 2.02 | 1.63 | 2.01 |
| Dependability 90% | $Mm^3/yr$ | 0.38 | 0.25 | 0.34 | 0.24 | 0.32 | 0.23 | 0.31 |
| Dependability 75% | $Mm^3/yr$ | 0.74 | 0.55 | 0.70 | 0.54 | 0.69 | 0.53 | 0.68 |
| Dependability 50% | $Mm^3/yr$ | 2.12 | 1.68 | 2.08 | 1.67 | 2.07 | 1.67 | 2.05 |
| Dependability 25% | $Mm^3/yr$ | 3.42 | 2.75 | 3.38 | 2.74 | 3.36 | 2.73 | 3.35 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 3.10 | 2.51 | 2.90 | 2.42 | 2.80 | 2.35 | 2.73 |
| Dependability 90% | $Mm^3/yr$ | 1.41 | 1.11 | 1.20 | 1.02 | 1.10 | 0.95 | 1.03 |
| Dependability 75% | $Mm^3/yr$ | 1.77 | 1.41 | 1.56 | 1.32 | 1.47 | 1.25 | 1.40 |
| Dependability 50% | $Mm^3/yr$ | 3.15 | 2.54 | 2.94 | 2.45 | 2.85 | 2.39 | 2.77 |
| Dependability 25% | $Mm^3/yr$ | 4.45 | 3.61 | 4.24 | 3.52 | 4.14 | 3.45 | 4.07 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 2.83 | 2.51 | 2.73 | 2.42 | 2.67 | 2.35 | 2.62 |
| Dependability 90% | $Mm^3/yr$ | 1.41 | 1.11 | 1.20 | 1.02 | 1.10 | 0.95 | 1.03 |
| Dependability 75% | $Mm^3/yr$ | 1.77 | 1.41 | 1.56 | 1.32 | 1.47 | 1.25 | 1.40 |
| Dependability 50% | $Mm^3/yr$ | 3.15 | 2.54 | 2.94 | 2.45 | 2.85 | 2.39 | 2.77 |
| Dependability 25% | $Mm^3/yr$ | 3.68 | 3.61 | 3.77 | 3.52 | 3.77 | 3.45 | 3.77 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 73 | 65 | 70 | 62 | 69 | 61 | 68 |
| | Dependability 90% | mm/yr | 36 | 29 | 31 | 26 | 28 | 25 | 27 |
| | Dependability 75% | mm/yr | 46 | 36 | 40 | 34 | 38 | 32 | 36 |
| | Dependability 50% | mm/yr | 81 | 66 | 76 | 63 | 74 | 62 | 72 |
| | Dependability 25% | mm/yr | 95 | 93 | 97 | 91 | 97 | 89 | 97 |
| Well Yield | | $10^3 m^3/yr$ | 18 | | | | | | |
| No. of Irrigation Wells | Existing | | 202 | 202 | 202 | 202 | 207 | 202 | 207 |
| | Additional | | | 0 | 5 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 3.68 | 3.68 | 3.77 | 3.68 | 3.77 | 3.68 | 3.77 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 0.74 | 0.74 | 0.75 | 0.74 | 0.75 | 0.74 | 0.75 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 4.82 | 5.37 | 4.72 | 5.28 | 4.66 | 5.21 | 4.61 |
| | Dependability 90% | $Mm^3/yr$ | 1.45 | 1.17 | 1.25 | 1.08 | 1.15 | 1.02 | 1.08 |
| | Dependability 75% | $Mm^3/yr$ | 2.23 | 2.07 | 2.03 | 1.99 | 1.93 | 1.92 | 1.86 |
| | Dependability 50% | $Mm^3/yr$ | 5.19 | 5.48 | 4.98 | 5.39 | 4.89 | 5.32 | 4.81 |
| | Dependability 25% | $Mm^3/yr$ | 7.21 | 8.68 | 7.29 | 8.59 | 7.29 | 8.53 | 7.29 |
| Depth | ted Mean | mm/yr | 124 | 139 | 122 | 136 | 120 | 135 | 119 |
| | Dependability 90% | mm/yr | 37 | 30 | 32 | 28 | 30 | 26 | 28 |
| | Dependability 75% | mm/yr | 58 | 54 | 52 | 51 | 50 | 50 | 48 |
| | Dependability 50% | mm/yr | 134 | 141 | 129 | 139 | 126 | 137 | 124 |
| | Dependability 25% | mm/yr | 186 | 224 | 188 | 222 | 188 | 220 | 188 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 13661 | | | | | | |
| | Total | Mill.Rs. | | 52.91 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 52.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.50 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.42 | 1.25 | 1.36 | 1.21 | 1.33 | 1.17 | 1.31 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.42 | 1.25 | 1.36 | 1.21 | 1.33 | 1.17 | 1.31 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 1.42 | 1.25 | 1.36 | 1.21 | 1.33 | 1.17 | 1.31 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.230 | 0.080 | 0.330 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Bhupal Sagar Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | CHITTORGARH |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.23 | 0.08 | 0.33 | 0.36 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3873 | 3873 | 3873 | 3873 | 3873 | 3873 | 3873 |
| SW On-Farm Irrigation Efficiency | % | 75.02 | 75.00 | 75.02 | 75.00 | 75.02 | 75.00 | 75.02 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.46 | 0.67 | 0.46 | 0.67 | 0.46 | 0.67 | 0.46 |
| Dependability 50% | $Mm^3/yr$ | 2.04 | 2.94 | 2.04 | 2.94 | 2.04 | 2.94 | 2.04 |
| Dependability 25% | $Mm^3/yr$ | 3.52 | 5.07 | 3.52 | 5.07 | 3.52 | 5.07 | 3.52 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.41 | 1.11 | 1.20 | 1.02 | 1.10 | 0.95 | 1.03 |
| Dependability 75% | $Mm^3/yr$ | 1.77 | 1.41 | 1.56 | 1.32 | 1.47 | 1.25 | 1.40 |
| Dependability 50% | $Mm^3/yr$ | 3.15 | 2.54 | 2.94 | 2.45 | 2.85 | 2.39 | 2.77 |
| Dependability 25% | $Mm^3/yr$ | 4.45 | 3.61 | 4.24 | 3.52 | 4.14 | 3.45 | 4.07 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.41 | 1.11 | 1.20 | 1.02 | 1.10 | 0.95 | 1.03 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 3.68 | 3.68 | 3.77 | 3.68 | 3.77 | 3.68 | 3.77 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 0.74 | 0.74 | 0.75 | 0.74 | 0.75 | 0.74 | 0.75 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 21.36 | 26.66 | 21.62 | 30.79 | 25.08 | 33.92 | 27.72 |
| CMLP Irrig. Intensity Dependability 90% | % | 7.45 | 7.00 | 6.48 | 6.43 | 5.94 | 6.03 | 5.57 |
| Dependability 75% | % | 11.80 | 12.41 | 10.89 | 11.80 | 10.31 | 11.40 | 9.94 |
| Dependability 50% | % | 28.31 | 32.94 | 27.60 | 32.17 | 26.90 | 31.77 | 26.53 |
| Dependability 25% | % | 40.00 | 52.37 | 40.96 | 51.46 | 40.66 | 51.07 | 40.66 |
| Weighted Mean | % | 26.40 | 32.33 | 26.22 | 31.57 | 25.71 | 31.17 | 25.47 |
| CMLP GW Use Dependability 90% | % | 96.81 | 94.31 | 96.28 | 93.84 | 95.97 | 93.44 | 95.69 |
| Dependability 75% | % | 78.80 | 67.06 | 76.66 | 65.57 | 75.48 | 64.37 | 74.14 |
| Dependability 50% | % | 57.03 | 41.78 | 55.51 | 40.84 | 54.63 | 40.09 | 53.93 |
| Dependability 25% | % | 45.22 | 34.14 | 46.44 | 34.90 | 46.48 | 34.39 | 46.48 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

Rate of Interest: 10.00%

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.84 | 0.00 | 5.84 | 0.00 | 5.84 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 1.42 | 7.09 | 1.36 | 7.05 | 1.33 | 7.01 | 1.31 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.84 | 0.00 | 5.84 | 0.00 | 5.84 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 1.42 | 7.09 | 1.36 | 7.05 | 1.33 | 7.01 | 1.31 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 21.36 | 26.66 | 21.62 | 30.79 | 25.08 | 33.92 | 27.72 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 3.33 | 4.03 | 3.27 | 3.96 | 3.23 | 3.91 | 3.20 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 4.82 | 5.37 | 4.72 | 5.28 | 4.66 | 5.21 | 4.61 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 33.02 | 29.04 | 3.98 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 33.02 | 29.04 | 3.98 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 171.23 | 139.04 | 32.20 |
| 5. Total Project Costs | Mill.Rs. | | 43.72 | 8.38 | 35.34 |
| 6. Project Capital Costs | Mill.Rs. | | 36.06 | 0.00 | 36.06 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 43.72 | 8.38 | 35.34 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 36.06 | 0.00 | 36.06 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 127.51 | 130.66 | -3.15 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.32 | 0.29 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 9310 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.93 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.91** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

# Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Bilas Irrigation Project**

## I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | 02693 | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Chambal | Linked to Project(s): | |
| District | Baran | Name(s): | |
| Groundwater Potential Zone (PZ) | | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 146.5 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 26.6 | Code: | |
| Present Dead Storage, $Mm^3$ | 1.79 | Name: | |

## II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.20 | 0.40 | 0.40 | 0.48 | 0.48 | 0.52 | 0.52 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.17 | 0.18 | 0.18 | 0.19 | 0.19 | 0.21 | 0.21 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 5,863 | 5,863 | 5,863 | 5,863 | 5,863 | 5,863 | 5,863 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 26.76 | | | | | | |
| 2010 Irrigated Area | | ha | 3800 | | | | | | |

## III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 79.97 | 79.97 | 79.97 | 79.97 | 79.97 | 79.97 | 79.97 |
| Dependability 90% | $Mm^3/yr$ | 37.45 | 37.45 | 37.45 | 37.45 | 37.45 | 37.45 | 37.45 |
| Dependability 75% | $Mm^3/yr$ | 49.61 | 49.61 | 49.61 | 49.61 | 49.61 | 49.61 | 49.61 |
| Dependability 50% | $Mm^3/yr$ | 73.03 | 73.03 | 73.03 | 73.03 | 73.03 | 73.03 | 73.03 |
| Dependability 25% | $Mm^3/yr$ | 90.21 | 90.21 | 90.21 | 90.21 | 90.21 | 90.21 | 90.21 |
| Weighted Mean | $Mm^3/yr$ | 66.91 | 66.91 | 66.91 | 66.91 | 66.91 | 66.91 | 66.91 |
| Losses from Reservoir Annual | % | 16.21 | | | | | | |
| During the Rabi Season | % | 7.42 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 218.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.03 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.32 | 0.32 | 0.96 | 0.96 | 1.60 | 1.60 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 26.60 | 26.42 | 26.42 | 26.07 | 26.07 | 25.72 | 25.72 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 24.63 | 24.46 | 24.46 | 24.14 | 24.14 | 23.81 | 23.81 |
| Dependability 90% | $Mm^3/yr$ | 24.63 | 24.46 | 24.46 | 24.14 | 24.14 | 23.81 | 23.81 |
| Dependability 75% | $Mm^3/yr$ | 24.63 | 24.46 | 24.46 | 24.14 | 24.14 | 23.81 | 23.81 |
| Dependability 50% | $Mm^3/yr$ | 24.63 | 24.46 | 24.46 | 24.14 | 24.14 | 23.81 | 23.81 |
| Dependability 25% | $Mm^3/yr$ | 24.63 | 24.46 | 24.46 | 24.14 | 24.14 | 23.81 | 23.81 |
| On-Farm Irrigation Efficiency | % | 51.00 | 70.00 | 51.00 | 70.00 | 51.00 | 70.00 | 51.00 |
| Off-Farm Irrigation Efficiency | % | 65.51 | 72.00 | 65.51 | 72.00 | 65.51 | 72.00 | 65.51 |
| Present Overall Irrigation Efficiency | % | 33.41 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Dependability 90% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Dependability 75% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Dependability 50% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Dependability 25% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 275 | 300 | 273 | 296 | 270 | 292 | 266 |
| Dependability 90% | mm/yr | 275 | 300 | 273 | 296 | 270 | 292 | 266 |
| Dependability 75% | mm/yr | 275 | 300 | 273 | 296 | 270 | 292 | 266 |
| Dependability 50% | mm/yr | 275 | 300 | 273 | 296 | 270 | 292 | 266 |
| Dependability 25% | mm/yr | 275 | 300 | 273 | 296 | 270 | 292 | 266 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 6.16 | 6.12 | 6.12 | 6.03 | 6.03 | 5.95 | 5.95 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 40.31 | 40.48 | 40.48 | 40.84 | 40.84 | 41.19 | 41.19 |
| Dependability 90% | $Mm^3/yr$ | 10.85 | 11.03 | 11.03 | 11.38 | 11.38 | 11.73 | 11.73 |
| Dependability 75% | $Mm^3/yr$ | 23.01 | 23.19 | 23.19 | 23.54 | 23.54 | 23.89 | 23.89 |
| Dependability 50% | $Mm^3/yr$ | 46.43 | 46.61 | 46.61 | 46.96 | 46.96 | 47.31 | 47.31 |
| Dependability 25% | $Mm^3/yr$ | 63.61 | 63.79 | 63.79 | 64.14 | 64.14 | 64.49 | 64.49 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 46.61 | | 46.61 | | 46.61 | | 46.61 |
| Weighted Mean | $Mm^3/yr$ | 11.48 | 8.81 | 11.40 | 8.69 | 11.25 | 8.57 | 11.10 |
| Dependability 90% | $Mm^3/yr$ | 11.48 | 8.81 | 11.40 | 8.69 | 11.25 | 8.57 | 11.10 |
| Dependability 75% | $Mm^3/yr$ | 11.48 | 8.81 | 11.40 | 8.69 | 11.25 | 8.57 | 11.10 |
| Dependability 50% | $Mm^3/yr$ | 11.48 | 8.81 | 11.40 | 8.69 | 11.25 | 8.57 | 11.10 |
| Dependability 25% | $Mm^3/yr$ | 11.48 | 8.81 | 11.40 | 8.69 | 11.25 | 8.57 | 11.10 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.82 | 0.50 | 0.75 | 0.48 | 0.73 | 0.47 | 0.71 |
| Dependability 90% | $Mm^3/yr$ | 0.82 | 0.50 | 0.75 | 0.48 | 0.73 | 0.47 | 0.71 |
| Dependability 75% | $Mm^3/yr$ | 0.82 | 0.50 | 0.75 | 0.48 | 0.73 | 0.47 | 0.71 |
| Dependability 50% | $Mm^3/yr$ | 0.82 | 0.50 | 0.75 | 0.48 | 0.73 | 0.47 | 0.71 |
| Dependability 25% | $Mm^3/yr$ | 0.82 | 0.50 | 0.75 | 0.48 | 0.73 | 0.47 | 0.71 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 12.30 | 9.31 | 12.16 | 9.17 | 11.98 | 9.04 | 11.81 |
| Dependability 90% | $Mm^3/yr$ | 12.30 | 9.31 | 12.16 | 9.17 | 11.98 | 9.04 | 11.81 |
| Dependability 75% | $Mm^3/yr$ | 12.30 | 9.31 | 12.16 | 9.17 | 11.98 | 9.04 | 11.81 |
| Dependability 50% | $Mm^3/yr$ | 12.30 | 9.31 | 12.16 | 9.17 | 11.98 | 9.04 | 11.81 |
| Dependability 25% | $Mm^3/yr$ | 12.30 | 9.31 | 12.16 | 9.17 | 11.98 | 9.04 | 11.81 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 90% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 50% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Dependability 25% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 12.33 | 9.36 | 12.21 | 9.23 | 12.04 | 9.11 | 11.87 |
| Dependability 90% | $Mm^3/yr$ | 12.33 | 9.36 | 12.21 | 9.23 | 12.04 | 9.11 | 11.87 |
| Dependability 75% | $Mm^3/yr$ | 12.33 | 9.36 | 12.21 | 9.23 | 12.04 | 9.11 | 11.87 |
| Dependability 50% | $Mm^3/yr$ | 12.33 | 9.36 | 12.21 | 9.23 | 12.04 | 9.11 | 11.87 |
| Dependability 25% | $Mm^3/yr$ | 12.33 | 9.36 | 12.21 | 9.23 | 12.04 | 9.11 | 11.87 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 90% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 75% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 50% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 25% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 90% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 75% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 50% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 25% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 257 | 202 | 251 | 199 | 247 | 196 | 243 |
| | Dependability 90% | mm/yr | 257 | 202 | 251 | 199 | 247 | 196 | 243 |
| | Dependability 75% | mm/yr | 257 | 202 | 251 | 199 | 247 | 196 | 243 |
| | Dependability 50% | mm/yr | 257 | 202 | 251 | 199 | 247 | 196 | 243 |
| | Dependability 25% | mm/yr | 257 | 202 | 251 | 199 | 247 | 196 | 243 |
| Well Yield | | $10^3 m^3/yr$ | 93 | | | | | | |
| No. of Irrigation Wells | Existing | | 311 | 311 | 311 | 311 | 311 | 311 | 311 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 28.80 | 28.80 | 28.80 | 28.80 | 28.80 | 28.80 | 28.80 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 5.76 | 5.76 | 5.76 | 5.76 | 5.76 | 5.76 | 5.76 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 31.18 | 29.49 | 30.75 | 29.03 | 30.27 | 28.62 | 29.83 |
| | Dependability 90% | $Mm^3/yr$ | 31.18 | 29.49 | 30.75 | 29.03 | 30.27 | 28.62 | 29.83 |
| | Dependability 75% | $Mm^3/yr$ | 31.18 | 29.49 | 30.75 | 29.03 | 30.27 | 28.62 | 29.83 |
| | Dependability 50% | $Mm^3/yr$ | 31.18 | 29.49 | 30.75 | 29.03 | 30.27 | 28.62 | 29.83 |
| | Dependability 25% | $Mm^3/yr$ | 31.18 | 29.49 | 30.75 | 29.03 | 30.27 | 28.62 | 29.83 |
| Depth | ted Mean | mm/yr | 532 | 503 | 524 | 495 | 516 | 488 | 509 |
| | Dependability 90% | mm/yr | 532 | 503 | 524 | 495 | 516 | 488 | 509 |
| | Dependability 75% | mm/yr | 532 | 503 | 524 | 495 | 516 | 488 | 509 |
| | Dependability 50% | mm/yr | 532 | 503 | 524 | 495 | 516 | 488 | 509 |
| | Dependability 25% | mm/yr | 532 | 503 | 524 | 495 | 516 | 488 | 509 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 8400 | | | | | | |
| | Total | Mill.Rs. | | 49.25 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 49.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.49 | | | | | | |
| Average Annual Cost | Mill.Rs | 7.37 | 5.82 | 7.21 | 5.71 | 7.08 | 5.62 | 6.97 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 7.37 | 5.82 | 7.21 | 5.71 | 7.08 | 5.62 | 6.97 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 7.37 | 5.82 | 7.21 | 5.71 | 7.08 | 5.62 | 6.97 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.230 | 0.260 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Bilas Irrigation Project |
| WRIS Project Code: | 02693 |
| Status: | Existing |
| River Basin: | Chambal |
| Irrigation Demand Zone (IDZ) | Baran |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.23 | 0.26 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 5863 | 5863 | 5863 | 5863 | 5863 | 5863 | 5863 |
| SW On-Farm Irrigation Efficiency | % | 51.00 | 70.00 | 51.00 | 70.00 | 51.00 | 70.00 | 51.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Dependability 75% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Dependability 50% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Dependability 25% | $Mm^3/yr$ | 16.13 | 17.61 | 16.03 | 17.38 | 15.81 | 17.15 | 15.60 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 75% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 50% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Dependability 25% | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Firm GW for Kharif | $Mm^3/yr$ | 15.05 | 11.87 | 14.72 | 11.65 | 14.46 | 11.47 | 14.23 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 28.80 | 28.80 | 28.80 | 28.80 | 28.80 | 28.80 | 28.80 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 5.76 | 5.76 | 5.76 | 5.76 | 5.76 | 5.76 | 5.76 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 127.12 | 152.45 | 134.62 | 173.31 | 150.63 | 188.04 | 159.91 |
| CMLP Irrig. Intensity Dependability 90% | % | 100.45 | 111.11 | 97.64 | 111.11 | 96.11 | 111.11 | 94.71 |
| Dependability 75% | % | 100.67 | 111.11 | 97.82 | 111.11 | 96.29 | 111.11 | 94.88 |
| Dependability 50% | % | 101.14 | 111.11 | 98.21 | 111.11 | 96.67 | 111.11 | 95.26 |
| Dependability 25% | % | 101.51 | 111.11 | 98.50 | 111.11 | 96.95 | 111.11 | 95.54 |
| Weighted Mean | % | 101.03 | 111.11 | 98.11 | 111.11 | 96.58 | 111.11 | 95.17 |
| CMLP GW Use Dependability 90% | % | 48.26 | 42.41 | 47.87 | 41.61 | 47.76 | 40.09 | 47.71 |
| Dependability 75% | % | 47.88 | 42.04 | 47.40 | 41.24 | 47.38 | 39.62 | 47.33 |
| Dependability 50% | % | 47.06 | 41.26 | 46.68 | 40.43 | 46.57 | 38.60 | 46.51 |
| Dependability 25% | % | 46.91 | 41.23 | 46.53 | 40.39 | 46.42 | 38.41 | 46.36 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.43 | 0.00 | 5.43 | 0.00 | 5.43 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 7.37 | 11.25 | 7.21 | 11.15 | 7.08 | 11.06 | 6.97 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.43 | 0.00 | 5.43 | 0.00 | 5.43 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 7.37 | 11.25 | 7.21 | 11.15 | 7.08 | 11.06 | 6.97 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 127.12 | 152.45 | 134.62 | 173.31 | 150.63 | 188.04 | 159.91 |
| Wtd.Mean net Irrigation water supply | $Mm^3$/yr | 18.01 | 21.23 | 17.74 | 20.91 | 17.46 | 20.61 | 17.21 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3$/yr | 31.18 | 29.49 | 30.75 | 29.03 | 30.27 | 28.62 | 29.83 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3$/yr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 181.38 | 189.12 | -7.74 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 181.38 | 189.12 | -7.74 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 974.69 | 856.47 | 118.22 |
| 5. Total Project Costs | Mill.Rs. | | 69.32 | 44.34 | 24.98 |
| 6. Project Capital Costs | Mill.Rs. | | 33.56 | 0.00 | 33.56 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 69.32 | 44.34 | 24.98 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 33.56 | 0.00 | 33.56 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 905.37 | 812.13 | 93.23 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.38 | 0.23 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 5725 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.34 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **3.78** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Chandrabhaga Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | BHILWARA,Rajsamand | Name(s): | |
| Groundwater Potential Zone (PZ) | Sahara,Railmagra | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 132 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 9.05 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.13 | 0.27 | 0.27 | 0.34 | 0.34 | 0.37 | 0.37 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.13 | 0.14 | 0.14 | 0.15 | 0.15 | 0.17 | 0.17 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,342 | 3,342 | 3,342 | 3,342 | 3,342 | 3,342 | 3,342 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 13.72 | | | | | | |
| 2010 Irrigated Area | | ha | 6912 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 9.59 | 9.59 | 9.59 | 9.59 | 9.59 | 9.59 | 9.59 |
| | Dependability 90% | $Mm^3/yr$ | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| | Dependability 75% | $Mm^3/yr$ | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |
| | Dependability 50% | $Mm^3/yr$ | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 |
| | Dependability 25% | $Mm^3/yr$ | 12.60 | 12.60 | 12.60 | 12.60 | 12.60 | 12.60 | 12.60 |
| | Weighted Mean | $Mm^3/yr$ | 4.95 | 4.95 | 4.95 | 4.95 | 4.95 | 4.95 | 4.95 |
| Losses from Reservoir | Annual | % | 14.85 | | | | | | |
| | During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.02 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.17 | 0.17 | 0.52 | 0.52 | 0.86 | 0.86 |
| - Part of Siltation in Dead Storage | | % | 100 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 9.05 | 8.88 | 8.88 | 8.53 | 8.53 | 8.19 | 8.19 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 3.50 | 3.45 | 3.45 | 3.34 | 3.34 | 3.24 | 3.24 |
| Dependability 90% | $Mm^3/yr$ | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| Dependability 50% | $Mm^3/yr$ | 2.69 | 2.69 | 2.69 | 2.69 | 2.69 | 2.69 | 2.69 |
| Dependability 25% | $Mm^3/yr$ | 8.39 | 8.23 | 8.23 | 7.91 | 7.91 | 7.59 | 7.59 |
| On-Farm Irrigation Efficiency | % | 16.67 | 70.00 | 16.67 | 70.00 | 16.67 | 70.00 | 16.67 |
| Off-Farm Irrigation Efficiency | % | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 |
| Present Overall Irrigation Efficiency | % | 9.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 1.89 | 2.48 | 1.86 | 2.41 | 1.81 | 2.33 | 1.75 |
| Dependability 90% | $Mm^3/yr$ | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.20 | 0.27 | 0.20 | 0.27 | 0.20 | 0.27 | 0.20 |
| Dependability 50% | $Mm^3/yr$ | 1.45 | 1.94 | 1.45 | 1.94 | 1.45 | 1.94 | 1.45 |
| Dependability 25% | $Mm^3/yr$ | 4.53 | 5.93 | 4.45 | 5.70 | 4.27 | 5.47 | 4.10 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 57 | 74 | 56 | 72 | 54 | 70 | 52 |
| Dependability 90% | mm/yr | 1 | 2 | 1 | 2 | 1 | 2 | 1 |
| Dependability 75% | mm/yr | 6 | 8 | 6 | 8 | 6 | 8 | 6 |
| Dependability 50% | mm/yr | 43 | 58 | 43 | 58 | 43 | 58 | 43 |
| Dependability 25% | mm/yr | 136 | 177 | 133 | 170 | 128 | 164 | 123 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.10 | 2.06 | 2.06 | 1.98 | 1.98 | 1.90 | 1.90 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 1.17 | 1.23 | 1.23 | 1.34 | 1.34 | 1.46 | 1.46 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 3.55 | 3.72 | 3.72 | 4.07 | 4.07 | 4.41 | 4.41 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 63.70 | | 63.70 | | 63.70 | | 63.70 |
| Weighted Mean | $Mm^3/yr$ | 2.23 | 1.24 | 2.20 | 1.20 | 2.13 | 1.17 | 2.06 |
| Dependability 90% | $Mm^3/yr$ | 0.06 | 0.03 | 0.06 | 0.03 | 0.06 | 0.03 | 0.06 |
| Dependability 75% | $Mm^3/yr$ | 0.24 | 0.13 | 0.24 | 0.13 | 0.24 | 0.13 | 0.24 |
| Dependability 50% | $Mm^3/yr$ | 1.71 | 0.97 | 1.71 | 0.97 | 1.71 | 0.97 | 1.71 |
| Dependability 25% | $Mm^3/yr$ | 5.35 | 2.96 | 5.24 | 2.85 | 5.04 | 2.73 | 4.84 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.06 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.06 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.06 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.06 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.06 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 2.29 | 1.25 | 2.21 | 1.20 | 2.13 | 1.17 | 2.06 |
| Dependability 90% | $Mm^3/yr$ | 0.12 | 0.04 | 0.07 | 0.03 | 0.06 | 0.03 | 0.06 |
| Dependability 75% | $Mm^3/yr$ | 0.29 | 0.14 | 0.25 | 0.13 | 0.24 | 0.13 | 0.24 |
| Dependability 50% | $Mm^3/yr$ | 1.77 | 0.98 | 1.73 | 0.97 | 1.71 | 0.97 | 1.71 |
| Dependability 25% | $Mm^3/yr$ | 5.40 | 2.97 | 5.26 | 2.85 | 5.04 | 2.73 | 4.84 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 90% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 50% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 25% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 2.31 | 1.29 | 2.25 | 1.25 | 2.17 | 1.21 | 2.11 |
| Dependability 90% | $Mm^3/yr$ | 0.14 | 0.08 | 0.11 | 0.08 | 0.10 | 0.08 | 0.11 |
| Dependability 75% | $Mm^3/yr$ | 0.32 | 0.18 | 0.29 | 0.18 | 0.28 | 0.18 | 0.29 |
| Dependability 50% | $Mm^3/yr$ | 1.79 | 1.01 | 1.76 | 1.01 | 1.76 | 1.02 | 1.76 |
| Dependability 25% | $Mm^3/yr$ | 5.43 | 3.01 | 5.29 | 2.89 | 5.08 | 2.78 | 4.88 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 2.50 | 1.33 | 2.29 | 1.21 | 2.13 | 1.13 | 2.02 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.12 | 0.15 | 0.04 | 0.06 | 0.00 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 0.50 | 0.22 | 0.33 | 0.14 | 0.24 | 0.09 | 0.20 |
| Dependability 50% | $Mm^3/yr$ | 1.98 | 1.05 | 1.80 | 0.97 | 1.72 | 0.93 | 1.67 |
| Dependability 25% | $Mm^3/yr$ | 5.61 | 3.05 | 5.33 | 2.85 | 5.04 | 2.69 | 4.80 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 2.50 | 1.33 | 2.29 | 1.21 | 2.13 | 1.13 | 2.02 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.12 | 0.15 | 0.04 | 0.06 | 0.00 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 0.50 | 0.22 | 0.33 | 0.14 | 0.24 | 0.09 | 0.20 |
| Dependability 50% | $Mm^3/yr$ | 1.98 | 1.05 | 1.80 | 0.97 | 1.72 | 0.93 | 1.67 |
| Dependability 25% | $Mm^3/yr$ | 5.61 | 3.05 | 5.33 | 2.85 | 5.04 | 2.69 | 4.80 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 75 | 40 | 68 | 36 | 64 | 34 | 61 |
| | Dependability 90% | mm/yr | 10 | 4 | 4 | 1 | 2 | 0 | 1 |
| | Dependability 75% | mm/yr | 15 | 7 | 10 | 4 | 7 | 3 | 6 |
| | Dependability 50% | mm/yr | 59 | 32 | 54 | 29 | 51 | 28 | 50 |
| | Dependability 25% | mm/yr | 168 | 91 | 160 | 85 | 151 | 81 | 144 |
| Well Yield | | $10^3 m^3/yr$ | 11 | | | | | | |
| No. of Irrigation Wells | Existing | | 657 | 657 | 657 | 657 | 657 | 657 | 657 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 4.39 | 3.81 | 4.15 | 3.61 | 3.94 | 3.46 | 3.77 |
| | Dependability 90% | $Mm^3/yr$ | 0.38 | 0.19 | 0.20 | 0.10 | 0.11 | 0.07 | 0.07 |
| | Dependability 75% | $Mm^3/yr$ | 0.70 | 0.49 | 0.53 | 0.41 | 0.44 | 0.36 | 0.40 |
| | Dependability 50% | $Mm^3/yr$ | 3.43 | 2.99 | 3.25 | 2.91 | 3.17 | 2.87 | 3.13 |
| | Dependability 25% | $Mm^3/yr$ | 10.15 | 8.98 | 9.78 | 8.55 | 9.32 | 8.16 | 8.90 |
| Depth | ted Mean | mm/yr | 131 | 114 | 124 | 108 | 118 | 103 | 113 |
| | Dependability 90% | mm/yr | 11 | 6 | 6 | 3 | 3 | 2 | 2 |
| | Dependability 75% | mm/yr | 21 | 15 | 16 | 12 | 13 | 11 | 12 |
| | Dependability 50% | mm/yr | 103 | 89 | 97 | 87 | 95 | 86 | 94 |
| | Dependability 25% | mm/yr | 304 | 269 | 293 | 256 | 279 | 244 | 266 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11285 | | | | | | |
| | Total | Mill.Rs. | | 37.71 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 37.71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.52 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.30 | 0.69 | 1.19 | 0.63 | 1.11 | 0.59 | 1.05 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.30 | 0.69 | 1.19 | 0.63 | 1.11 | 0.59 | 1.05 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 1.30 | 0.69 | 1.19 | 0.63 | 1.11 | 0.59 | 1.05 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.260 | 0.230 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Chandrabhaga Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | BHILWARA,Rajsamand |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.26 | 0.23 | 0.33 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| . | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3342 | 3342 | 3342 | 3342 | 3342 | 3342 | 3342 |
| SW On-Farm Irrigation Efficiency | % | 16.67 | 70.00 | 16.67 | 70.00 | 16.67 | 70.00 | 16.67 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.20 | 0.27 | 0.20 | 0.27 | 0.20 | 0.27 | 0.20 |
| Dependability 50% | $Mm^3/yr$ | 1.45 | 1.94 | 1.45 | 1.94 | 1.45 | 1.94 | 1.45 |
| Dependability 25% | $Mm^3/yr$ | 4.53 | 5.93 | 4.45 | 5.70 | 4.27 | 5.47 | 4.10 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.12 | 0.15 | 0.04 | 0.06 | 0.00 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 0.50 | 0.22 | 0.33 | 0.14 | 0.24 | 0.09 | 0.20 |
| Dependability 50% | $Mm^3/yr$ | 1.98 | 1.05 | 1.80 | 0.97 | 1.72 | 0.93 | 1.67 |
| Dependability 25% | $Mm^3/yr$ | 5.61 | 3.05 | 5.33 | 2.85 | 5.04 | 2.69 | 4.80 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.33 | 0.12 | 0.15 | 0.04 | 0.06 | 0.00 | 0.02 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 | 7.02 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 14.30 | 19.08 | 12.54 | 21.82 | 14.22 | 24.62 | 16.02 |
| CMLP Irrig. Intensity Dependability 90% | % | 1.71 | 1.13 | 0.87 | 0.61 | 0.40 | 0.00 | 0.17 |
| Dependability 75% | % | 2.80 | 2.92 | 2.04 | 2.35 | 1.53 | 2.08 | 1.31 |
| Dependability 50% | % | 11.90 | 17.95 | 11.83 | 16.92 | 11.03 | 16.66 | 10.80 |
| Dependability 25% | % | 34.34 | 54.01 | 35.31 | 49.87 | 32.48 | 47.58 | 30.93 |
| Weighted Mean | % | 15.10 | 22.92 | 15.06 | 21.07 | 13.73 | 20.07 | 13.06 |
| CMLP GW Use Dependability 90% | % | 86.70 | 63.99 | 74.76 | 36.23 | 55.96 | 12.54 | 28.51 |
| Dependability 75% | % | 71.77 | 43.66 | 61.74 | 33.04 | 54.37 | 24.94 | 48.99 |
| Dependability 50% | % | 56.48 | 30.85 | 54.48 | 30.71 | 53.59 | 29.65 | 52.93 |
| Dependability 25% | % | 53.31 | 27.96 | 53.25 | 29.80 | 52.14 | 29.42 | 53.13 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.16 | 0.00 | 4.16 | 0.00 | 4.16 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 1.30 | 4.85 | 1.19 | 4.79 | 1.11 | 4.75 | 1.05 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.16 | 0.00 | 4.16 | 0.00 | 4.16 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 1.30 | 4.85 | 1.19 | 4.79 | 1.11 | 4.75 | 1.05 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 14.30 | 19.08 | 12.54 | 21.82 | 14.22 | 24.62 | 16.02 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 1.94 | 2.73 | 1.80 | 2.59 | 1.69 | 2.48 | 1.61 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 4.39 | 3.81 | 4.15 | 3.61 | 3.94 | 3.46 | 3.77 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 23.22 | 25.28 | -2.07 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 23.22 | 25.28 | -2.07 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 122.38 | 80.24 | 42.14 |
| 5. Total Project Costs | Mill.Rs. | | 29.87 | 7.22 | 22.65 |
| 6. Project Capital Costs | Mill.Rs. | | 25.70 | 0.00 | 25.70 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 29.87 | 7.22 | 22.65 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 25.70 | 0.00 | 25.70 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 92.51 | 73.02 | 19.49 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.29 | 0.29 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7691 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.65 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **1.76** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Chandsen Bheru Sagar Irrigation Project**

| I. Water Resources Information System (WRIS) Data | | | |
|---|---|---|---|
| WRIS Project Code: | 02693 | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Tonk | Name(s): | |
| Groundwater Potential Zone (PZ) | Malpura. | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 74 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 13.43 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

**II. Priority Water Demands** (inside the project command area), Gross

(**i**rrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.10 | 0.20 | 0.20 | 0.24 | 0.24 | 0.27 | 0.27 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.10 | 0.10 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 2,600 | 2,600 | 2,600 | 2,600 | 2,600 | 2,600 | 2,600 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 12.37 | | | | | | |
| 2010 Irrigated Area | | ha | 2597 | | | | | | |

**III. Water Sources**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 20.73 | 20.73 | 20.73 | 20.73 | 20.73 | 20.73 | 20.73 |
| | Dependability 90% | $Mm^3/yr$ | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| | Dependability 75% | $Mm^3/yr$ | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| | Dependability 50% | $Mm^3/yr$ | 11.20 | 11.20 | 11.20 | 11.20 | 11.20 | 11.20 | 11.20 |
| | Dependability 25% | $Mm^3/yr$ | 36.00 | 36.00 | 36.00 | 36.00 | 36.00 | 36.00 | 36.00 |
| | Weighted Mean | $Mm^3/yr$ | 15.23 | 15.23 | 15.23 | 15.23 | 15.23 | 15.23 | 15.23 |
| Losses from Reservoir | Annual | % | 24.82 | | | | | | |
| | During the Rabi Season | % | 10.93 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.01 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.10 | 0.10 | 0.29 | 0.29 | 0.48 | 0.48 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 13.43 | 13.33 | 13.33 | 13.14 | 13.14 | 12.95 | 12.95 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 6.32 | 6.29 | 6.29 | 6.23 | 6.23 | 6.17 | 6.17 |
| Dependability 90% | $Mm^3/yr$ | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| Dependability 75% | $Mm^3/yr$ | 0.62 | 0.62 | 0.62 | 0.62 | 0.62 | 0.62 | 0.62 |
| Dependability 50% | $Mm^3/yr$ | 9.98 | 9.98 | 9.98 | 9.98 | 9.98 | 9.98 | 9.98 |
| Dependability 25% | $Mm^3/yr$ | 11.96 | 11.88 | 11.88 | 11.70 | 11.70 | 11.53 | 11.53 |
| On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| Off-Farm Irrigation Efficiency | % | 47.95 | 72.00 | 47.95 | 72.00 | 47.95 | 72.00 | 47.95 |
| Present Overall Irrigation Efficiency | % | 26.85 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 3.03 | 4.53 | 3.02 | 4.49 | 2.99 | 4.44 | 2.96 |
| Dependability 90% | $Mm^3/yr$ | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 |
| Dependability 75% | $Mm^3/yr$ | 0.30 | 0.45 | 0.30 | 0.45 | 0.30 | 0.45 | 0.30 |
| Dependability 50% | $Mm^3/yr$ | 4.78 | 7.18 | 4.78 | 7.18 | 4.78 | 7.18 | 4.78 |
| Dependability 25% | $Mm^3/yr$ | 5.74 | 8.55 | 5.69 | 8.43 | 5.61 | 8.30 | 5.53 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 117 | 174 | 116 | 173 | 115 | 171 | 114 |
| Dependability 90% | mm/yr | 5 | 7 | 5 | 7 | 5 | 7 | 5 |
| Dependability 75% | mm/yr | 11 | 17 | 11 | 17 | 11 | 17 | 11 |
| Dependability 50% | mm/yr | 184 | 276 | 184 | 276 | 184 | 276 | 184 |
| Dependability 25% | mm/yr | 221 | 329 | 219 | 324 | 216 | 319 | 213 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.99 | 2.97 | 2.97 | 2.93 | 2.93 | 2.88 | 2.88 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 8.13 | 8.16 | 8.16 | 8.23 | 8.23 | 8.30 | 8.30 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 22.57 | 22.67 | 22.67 | 22.86 | 22.86 | 23.05 | 23.05 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 51.21 | | 51.21 | | 51.21 | | 51.21 |
| Weighted Mean | $Mm^3/yr$ | 3.24 | 2.27 | 3.22 | 2.24 | 3.19 | 2.22 | 3.16 |
| Dependability 90% | $Mm^3/yr$ | 0.14 | 0.10 | 0.14 | 0.10 | 0.14 | 0.10 | 0.14 |
| Dependability 75% | $Mm^3/yr$ | 0.32 | 0.22 | 0.32 | 0.22 | 0.32 | 0.22 | 0.32 |
| Dependability 50% | $Mm^3/yr$ | 5.11 | 3.59 | 5.11 | 3.59 | 5.11 | 3.59 | 5.11 |
| Dependability 25% | $Mm^3/yr$ | 6.13 | 4.28 | 6.08 | 4.21 | 5.99 | 4.15 | 5.90 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.32 | 0.19 | 0.29 | 0.18 | 0.28 | 0.18 | 0.26 |
| Dependability 90% | $Mm^3/yr$ | 0.32 | 0.19 | 0.29 | 0.18 | 0.28 | 0.18 | 0.26 |
| Dependability 75% | $Mm^3/yr$ | 0.32 | 0.19 | 0.29 | 0.18 | 0.28 | 0.18 | 0.26 |
| Dependability 50% | $Mm^3/yr$ | 0.32 | 0.19 | 0.29 | 0.18 | 0.28 | 0.18 | 0.26 |
| Dependability 25% | $Mm^3/yr$ | 0.32 | 0.19 | 0.29 | 0.18 | 0.28 | 0.18 | 0.26 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 3.56 | 2.46 | 3.51 | 2.43 | 3.47 | 2.40 | 3.42 |
| Dependability 90% | $Mm^3/yr$ | 0.46 | 0.29 | 0.43 | 0.28 | 0.41 | 0.27 | 0.40 |
| Dependability 75% | $Mm^3/yr$ | 0.64 | 0.42 | 0.61 | 0.41 | 0.60 | 0.40 | 0.58 |
| Dependability 50% | $Mm^3/yr$ | 5.43 | 3.79 | 5.40 | 3.78 | 5.38 | 3.77 | 5.37 |
| Dependability 25% | $Mm^3/yr$ | 6.45 | 4.47 | 6.37 | 4.40 | 6.27 | 4.33 | 6.17 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 90% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 25% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 3.58 | 2.49 | 3.54 | 2.46 | 3.50 | 2.43 | 3.46 |
| Dependability 90% | $Mm^3/yr$ | 0.47 | 0.32 | 0.45 | 0.31 | 0.44 | 0.31 | 0.43 |
| Dependability 75% | $Mm^3/yr$ | 0.66 | 0.44 | 0.64 | 0.44 | 0.63 | 0.43 | 0.62 |
| Dependability 50% | $Mm^3/yr$ | 5.45 | 3.81 | 5.42 | 3.81 | 5.41 | 3.80 | 5.41 |
| Dependability 25% | $Mm^3/yr$ | 6.46 | 4.49 | 6.40 | 4.43 | 6.30 | 4.36 | 6.20 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 4.65 | 3.46 | 4.51 | 3.38 | 4.42 | 3.31 | 4.34 |
| Dependability 90% | $Mm^3/yr$ | 1.54 | 1.29 | 1.42 | 1.23 | 1.36 | 1.19 | 1.31 |
| Dependability 75% | $Mm^3/yr$ | 1.73 | 1.41 | 1.61 | 1.36 | 1.55 | 1.31 | 1.50 |
| Dependability 50% | $Mm^3/yr$ | 6.52 | 4.78 | 6.39 | 4.73 | 6.33 | 4.68 | 6.29 |
| Dependability 25% | $Mm^3/yr$ | 7.53 | 5.46 | 7.37 | 5.35 | 7.22 | 5.24 | 7.08 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 2.96 | 3.06 | 3.88 | 3.04 | 3.85 | 3.02 | 3.83 |
| Dependability 90% | $Mm^3/yr$ | 1.54 | 1.29 | 1.42 | 1.23 | 1.36 | 1.19 | 1.31 |
| Dependability 75% | $Mm^3/yr$ | 1.73 | 1.41 | 1.61 | 1.36 | 1.55 | 1.31 | 1.50 |
| Dependability 50% | $Mm^3/yr$ | 4.08 | 4.51 | 5.88 | 4.51 | 5.88 | 4.51 | 5.88 |
| Dependability 25% | $Mm^3/yr$ | 4.08 | 4.51 | 5.88 | 4.51 | 5.88 | 4.51 | 5.88 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 114 | 118 | 149 | 117 | 148 | 116 | 147 |
| | Dependability 90% | mm/yr | 59 | 49 | 55 | 47 | 52 | 46 | 51 |
| | Dependability 75% | mm/yr | 66 | 54 | 62 | 52 | 59 | 51 | 58 |
| | Dependability 50% | mm/yr | 157 | 174 | 226 | 174 | 226 | 174 | 226 |
| | Dependability 25% | mm/yr | 157 | 174 | 226 | 174 | 226 | 174 | 226 |
| Well Yield | | $10^3 m^3/yr$ | 36 | | | | | | |
| No. of Irrigation Wells | Existing | | 113 | 113 | 113 | 125 | 163 | 125 | 163 |
| | Additional | | | 12 | 50 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 4.08 | 4.51 | 5.88 | 4.51 | 5.88 | 4.51 | 5.88 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 0.82 | 0.90 | 1.18 | 0.90 | 1.18 | 0.90 | 1.18 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 6.00 | 7.59 | 6.90 | 7.52 | 6.84 | 7.46 | 6.79 |
| | Dependability 90% | $Mm^3/yr$ | 1.67 | 1.48 | 1.55 | 1.42 | 1.49 | 1.38 | 1.44 |
| | Dependability 75% | $Mm^3/yr$ | 2.03 | 1.86 | 1.90 | 1.81 | 1.84 | 1.76 | 1.80 |
| | Dependability 50% | $Mm^3/yr$ | 8.86 | 11.69 | 10.67 | 11.69 | 10.67 | 11.69 | 10.67 |
| | Dependability 25% | $Mm^3/yr$ | 9.81 | 13.06 | 11.58 | 12.94 | 11.49 | 12.81 | 11.41 |
| Depth | ted Mean | mm/yr | 231 | 292 | 265 | 289 | 263 | 287 | 261 |
| | Dependability 90% | mm/yr | 64 | 57 | 60 | 55 | 57 | 53 | 55 |
| | Dependability 75% | mm/yr | 78 | 72 | 73 | 70 | 71 | 68 | 69 |
| | Dependability 50% | mm/yr | 341 | 450 | 410 | 450 | 410 | 450 | 410 |
| | Dependability 25% | mm/yr | 377 | 502 | 445 | 498 | 442 | 493 | 439 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 16744 | | | | | | |
| | Total | Mill.Rs. | | 43.53 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | 55 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.66 | 2.75 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | 18 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.22 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 44.41 | 3.65 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.01 | 0.03 | 0.01 | 0.03 | 0.01 | 0.03 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.01 | 0.05 | 0.01 | 0.05 | 0.01 | 0.05 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.50 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.48 | 1.53 | 1.94 | 1.52 | 1.93 | 1.51 | 1.92 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.48 | 1.53 | 1.94 | 1.52 | 1.93 | 1.51 | 1.92 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | | 1.55 | 2.01 | 1.54 | 2.00 | 1.53 | 1.99 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.280 | 0.180 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Chandsen Bheru Sagar Irrigation Project |
| WRIS Project Code: | 02693 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Tonk |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.28 | 0.18 | 0.36 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| . | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 2600 | 2600 | 2600 | 2600 | 2600 | 2600 | 2600 |
| SW On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 |
| Dependability 75% | $Mm^3/yr$ | 0.30 | 0.45 | 0.30 | 0.45 | 0.30 | 0.45 | 0.30 |
| Dependability 50% | $Mm^3/yr$ | 4.78 | 7.18 | 4.78 | 7.18 | 4.78 | 7.18 | 4.78 |
| Dependability 25% | $Mm^3/yr$ | 5.74 | 8.55 | 5.69 | 8.43 | 5.61 | 8.30 | 5.53 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.54 | 1.29 | 1.42 | 1.23 | 1.36 | 1.19 | 1.31 |
| Dependability 75% | $Mm^3/yr$ | 1.73 | 1.41 | 1.61 | 1.36 | 1.55 | 1.31 | 1.50 |
| Dependability 50% | $Mm^3/yr$ | 6.52 | 4.78 | 6.39 | 4.73 | 6.33 | 4.68 | 6.29 |
| Dependability 25% | $Mm^3/yr$ | 7.53 | 5.46 | 7.37 | 5.35 | 7.22 | 5.24 | 7.08 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.54 | 1.29 | 1.42 | 1.23 | 1.36 | 1.19 | 1.31 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 4.08 | 4.51 | 5.88 | 4.51 | 5.88 | 4.51 | 5.88 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 0.82 | 0.90 | 1.18 | 0.90 | 1.18 | 0.90 | 1.18 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 29.52 | 42.84 | 33.20 | 48.28 | 37.22 | 53.92 | 41.61 |
| CMLP Irrig. Intensity Dependability 90% | % | 13.68 | 13.98 | 12.68 | 12.65 | 11.46 | 12.26 | 11.08 |
| Dependability 75% | % | 16.46 | 17.54 | 15.45 | 16.00 | 14.06 | 15.60 | 13.69 |
| Dependability 50% | % | 68.39 | 107.75 | 83.27 | 101.35 | 78.32 | 101.35 | 78.32 |
| Dependability 25% | % | 75.60 | 119.51 | 90.25 | 112.29 | 84.25 | 111.24 | 83.68 |
| Weighted Mean | % | 46.60 | 69.85 | 54.09 | 65.43 | 50.43 | 64.86 | 50.05 |
| CMLP GW Use Dependability 90% | % | 92.34 | 86.98 | 91.74 | 86.48 | 91.41 | 86.04 | 91.12 |
| Dependability 75% | % | 85.19 | 75.61 | 84.23 | 74.87 | 83.71 | 74.23 | 83.26 |
| Dependability 50% | % | 43.34 | 35.16 | 52.17 | 34.67 | 53.07 | 34.67 | 52.35 |
| Dependability 25% | % | 37.99 | 29.65 | 46.92 | 29.93 | 47.56 | 30.29 | 47.95 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.90 | 0.41 | 4.90 | 0.41 | 4.90 | 0.41 |
| Annuity Total Project Cost | Mill.Rs./yr | 0.00 | 6.45 | 2.43 | 6.44 | 2.41 | 6.43 | 2.40 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.90 | 0.41 | 4.90 | 0.41 | 4.90 | 0.41 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 0.00 | 6.45 | 2.43 | 6.44 | 2.41 | 6.43 | 2.40 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 29.52 | 42.84 | 33.20 | 48.28 | 37.22 | 53.92 | 41.61 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 3.62 | 5.47 | 4.21 | 5.42 | 4.18 | 5.37 | 4.15 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 6.00 | 7.59 | 6.90 | 7.52 | 6.84 | 7.46 | 6.79 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 46.79 | 42.52 | 4.27 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 46.79 | 42.52 | 4.27 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 273.55 | 211.74 | 61.81 |
| 5. Total Project Costs | Mill.Rs. | | 39.83 | 14.96 | 24.86 |
| 6. Project Capital Costs | Mill.Rs. | | 30.28 | 2.55 | 27.73 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 39.83 | 14.96 | 24.86 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 30.28 | 2.55 | 27.73 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 233.72 | 196.77 | 36.95 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.85 | 0.35 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 11646 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.93 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **2.22** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

# Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Chhaparwada Irrigation Project**

## I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | BANAS 3 | Linked to Project(s): | |
| District | JAIPUR | Name(s): | |
| Groundwater Potential Zone (PZ) | DUDU | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 748 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 41.82 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

## II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.81 | 1.46 | 1.46 | 1.81 | 1.81 | 2.02 | 2.02 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.30 | 0.32 | 0.32 | 0.37 | 0.37 | 0.42 | 0.42 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 11,745 | 11,745 | 11,745 | 11,745 | 11,745 | 11,745 | 11,745 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 18.91 | | | | | | |
| 2010 Irrigated Area | | ha | 3003 | | | | | | |

## III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 31.51 | 31.51 | 31.51 | 31.51 | 31.51 | 31.51 | 31.51 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Dependability 50% | $Mm^3/yr$ | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 |
| Dependability 25% | $Mm^3/yr$ | 37.30 | 37.30 | 37.30 | 37.30 | 37.30 | 37.30 | 37.30 |
| Weighted Mean | $Mm^3/yr$ | 11.80 | 11.80 | 11.80 | 11.80 | 11.80 | 11.80 | 11.80 |
| Losses from Reservoir Annual | % | 19.82 | | | | | | |
| During the Rabi Season | % | 8.65 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.10 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.98 | 0.98 | 2.94 | 2.94 | 4.90 | 4.90 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 41.82 | 40.84 | 40.84 | 38.88 | 38.88 | 36.92 | 36.92 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 10.78 | 10.78 | 10.78 | 10.78 | 10.78 | 10.68 | 10.68 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| Dependability 50% | $Mm^3/yr$ | 3.01 | 3.01 | 3.01 | 3.01 | 3.01 | 3.01 | 3.01 |
| Dependability 25% | $Mm^3/yr$ | 34.07 | 34.07 | 34.07 | 34.07 | 34.07 | 33.73 | 33.73 |
| On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| Off-Farm Irrigation Efficiency | % | 79.14 | 79.00 | 79.14 | 79.00 | 79.14 | 79.00 | 79.14 |
| Present Overall Irrigation Efficiency | % | 44.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 8.53 | 8.52 | 8.53 | 8.52 | 8.53 | 8.44 | 8.45 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| Dependability 50% | $Mm^3/yr$ | 2.39 | 2.38 | 2.39 | 2.38 | 2.39 | 2.38 | 2.39 |
| Dependability 25% | $Mm^3/yr$ | 26.97 | 26.92 | 26.97 | 26.92 | 26.97 | 26.64 | 26.69 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 73 | 73 | 73 | 73 | 73 | 72 | 72 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Dependability 50% | mm/yr | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Dependability 25% | mm/yr | 230 | 229 | 230 | 229 | 230 | 227 | 227 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 8.52 | 8.52 | 8.52 | 8.52 | 8.52 | 8.43 | 8.43 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.11 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 | 0.38 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 2.73 | 2.73 | 2.73 | 2.73 | 2.73 | 2.73 | 2.73 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 39.20 | | 39.20 | | 39.20 | | 39.20 |
| Weighted Mean | $Mm^3/yr$ | 4.23 | 4.07 | 4.23 | 4.07 | 4.23 | 4.03 | 4.19 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.11 | 0.10 | 0.11 | 0.10 | 0.11 | 0.10 | 0.11 |
| Dependability 50% | $Mm^3/yr$ | 1.18 | 1.14 | 1.18 | 1.14 | 1.18 | 1.14 | 1.18 |
| Dependability 25% | $Mm^3/yr$ | 13.36 | 12.86 | 13.36 | 12.86 | 13.36 | 12.73 | 13.22 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.49 | 0.19 | 0.29 | 0.11 | 0.17 | 0.06 | 0.09 |
| Dependability 90% | $Mm^3/yr$ | 0.49 | 0.19 | 0.29 | 0.11 | 0.17 | 0.06 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.49 | 0.19 | 0.29 | 0.11 | 0.17 | 0.06 | 0.09 |
| Dependability 50% | $Mm^3/yr$ | 0.49 | 0.19 | 0.29 | 0.11 | 0.17 | 0.06 | 0.09 |
| Dependability 25% | $Mm^3/yr$ | 0.49 | 0.19 | 0.29 | 0.11 | 0.17 | 0.06 | 0.09 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 4.71 | 4.26 | 4.51 | 4.18 | 4.39 | 4.09 | 4.27 |
| Dependability 90% | $Mm^3/yr$ | 0.49 | 0.19 | 0.29 | 0.11 | 0.17 | 0.06 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.59 | 0.29 | 0.39 | 0.21 | 0.27 | 0.16 | 0.19 |
| Dependability 50% | $Mm^3/yr$ | 1.67 | 1.33 | 1.47 | 1.25 | 1.35 | 1.20 | 1.27 |
| Dependability 25% | $Mm^3/yr$ | 13.84 | 13.05 | 13.64 | 12.97 | 13.52 | 12.79 | 13.31 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 40 | 38 | 38 | 36 | 36 | 30 | 30 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.10 | 0.16 | 0.16 | 0.20 | 0.20 | 0.22 | 0.22 |
| Dependability 90% | $Mm^3/yr$ | 0.10 | 0.16 | 0.16 | 0.20 | 0.20 | 0.22 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 0.10 | 0.16 | 0.16 | 0.20 | 0.20 | 0.22 | 0.22 |
| Dependability 50% | $Mm^3/yr$ | 0.10 | 0.16 | 0.16 | 0.20 | 0.20 | 0.22 | 0.22 |
| Dependability 25% | $Mm^3/yr$ | 0.10 | 0.16 | 0.16 | 0.20 | 0.20 | 0.22 | 0.22 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 4.81 | 4.42 | 4.67 | 4.38 | 4.59 | 4.31 | 4.50 |
| Dependability 90% | $Mm^3/yr$ | 0.59 | 0.35 | 0.45 | 0.31 | 0.36 | 0.28 | 0.31 |
| Dependability 75% | $Mm^3/yr$ | 0.69 | 0.46 | 0.55 | 0.41 | 0.47 | 0.38 | 0.42 |
| Dependability 50% | $Mm^3/yr$ | 1.77 | 1.49 | 1.63 | 1.45 | 1.54 | 1.42 | 1.49 |
| Dependability 25% | $Mm^3/yr$ | 13.94 | 13.21 | 13.80 | 13.17 | 13.72 | 13.01 | 13.53 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 6.43 | 5.37 | 5.62 | 4.93 | 5.14 | 4.60 | 4.79 |
| Dependability 90% | $Mm^3/yr$ | 2.21 | 1.30 | 1.40 | 0.86 | 0.91 | 0.57 | 0.60 |
| Dependability 75% | $Mm^3/yr$ | 2.31 | 1.41 | 1.50 | 0.96 | 1.02 | 0.67 | 0.71 |
| Dependability 50% | $Mm^3/yr$ | 3.39 | 2.44 | 2.58 | 2.00 | 2.09 | 1.71 | 1.78 |
| Dependability 25% | $Mm^3/yr$ | 15.56 | 14.16 | 14.75 | 13.72 | 14.27 | 13.30 | 13.82 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 6.43 | 5.37 | 5.62 | 4.93 | 5.14 | 4.60 | 4.79 |
| Dependability 90% | $Mm^3/yr$ | 2.21 | 1.30 | 1.40 | 0.86 | 0.91 | 0.57 | 0.60 |
| Dependability 75% | $Mm^3/yr$ | 2.31 | 1.41 | 1.50 | 0.96 | 1.02 | 0.67 | 0.71 |
| Dependability 50% | $Mm^3/yr$ | 3.39 | 2.44 | 2.58 | 2.00 | 2.09 | 1.71 | 1.78 |
| Dependability 25% | $Mm^3/yr$ | 15.56 | 14.16 | 14.75 | 13.72 | 14.27 | 13.30 | 13.82 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 55 | 46 | 48 | 42 | 44 | 39 | 41 |
| | Dependability 90% | mm/yr | 19 | 11 | 12 | 7 | 8 | 5 | 5 |
| | Dependability 75% | mm/yr | 20 | 12 | 13 | 8 | 9 | 6 | 6 |
| | Dependability 50% | mm/yr | 29 | 21 | 22 | 17 | 18 | 15 | 15 |
| | Dependability 25% | mm/yr | 133 | 121 | 126 | 117 | 121 | 113 | 118 |
| Well Yield | | $10^3 m^3/yr$ | 20 | | | | | | |
| No. of Irrigation Wells | Existing | | 1120 | 1120 | 1120 | 1120 | 1120 | 1120 | 1120 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 22.62 | 22.62 | 22.62 | 22.62 | 22.62 | 22.62 | 22.62 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 4.52 | 4.52 | 4.52 | 4.52 | 4.52 | 4.52 | 4.52 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 14.96 | 13.89 | 14.15 | 13.44 | 13.67 | 13.04 | 13.24 |
| | Dependability 90% | $Mm^3/yr$ | 2.21 | 1.30 | 1.40 | 0.86 | 0.91 | 0.57 | 0.60 |
| | Dependability 75% | $Mm^3/yr$ | 2.53 | 1.62 | 1.72 | 1.18 | 1.24 | 0.89 | 0.92 |
| | Dependability 50% | $Mm^3/yr$ | 5.77 | 4.82 | 4.96 | 4.38 | 4.48 | 4.09 | 4.17 |
| | Dependability 25% | $Mm^3/yr$ | 42.53 | 41.08 | 41.72 | 40.64 | 41.24 | 39.95 | 40.51 |
| Depth | ted Mean | mm/yr | 127 | 118 | 120 | 114 | 116 | 111 | 113 |
| | Dependability 90% | mm/yr | 19 | 11 | 12 | 7 | 8 | 5 | 5 |
| | Dependability 75% | mm/yr | 22 | 14 | 15 | 10 | 11 | 8 | 8 |
| | Dependability 50% | mm/yr | 49 | 41 | 42 | 37 | 38 | 35 | 35 |
| | Dependability 25% | mm/yr | 362 | 350 | 355 | 346 | 351 | 340 | 345 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 14370 | | | | | | |
| | Total | Mill.Rs. | | 168.78 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 168.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.49 | | | | | | |
| Average Annual Cost | Mill.Rs | 3.15 | 2.63 | 2.75 | 2.41 | 2.52 | 2.25 | 2.34 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 3.15 | 2.63 | 2.75 | 2.41 | 2.52 | 2.25 | 2.34 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 3.15 | 2.63 | 2.75 | 2.41 | 2.52 | 2.25 | 2.34 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.231 | 0.154 | 0.329 | 0.286 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Chhaparwada Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | BANAS 3 |
| Irrigation Demand Zone (IDZ) | JAIPUR |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.231 | 0.154 | 0.329 | 0.286 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 11745 | 11745 | 11745 | 11745 | 11745 | 11745 | 11745 |
| SW On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| Dependability 50% | $Mm^3/yr$ | 2.39 | 2.38 | 2.39 | 2.38 | 2.39 | 2.38 | 2.39 |
| Dependability 25% | $Mm^3/yr$ | 26.97 | 26.92 | 26.97 | 26.92 | 26.97 | 26.64 | 26.69 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.21 | 1.30 | 1.40 | 0.86 | 0.91 | 0.57 | 0.60 |
| Dependability 75% | $Mm^3/yr$ | 2.31 | 1.41 | 1.50 | 0.96 | 1.02 | 0.67 | 0.71 |
| Dependability 50% | $Mm^3/yr$ | 3.39 | 2.44 | 2.58 | 2.00 | 2.09 | 1.71 | 1.78 |
| Dependability 25% | $Mm^3/yr$ | 15.56 | 14.16 | 14.75 | 13.72 | 14.27 | 13.30 | 13.82 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.21 | 1.30 | 1.40 | 0.86 | 0.91 | 0.57 | 0.60 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 22.62 | 22.62 | 22.62 | 22.62 | 22.62 | 22.62 | 22.62 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 4.52 | 4.52 | 4.52 | 4.52 | 4.52 | 4.52 | 4.52 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 72.81 | 83.09 | 70.13 | 104.54 | 87.87 | 125.20 | 104.95 |
| CMLP Irrig. Intensity Dependability 90% | % | 3.86 | 2.63 | 2.44 | 1.61 | 1.48 | 1.07 | 0.97 |
| Dependability 75% | % | 4.38 | 3.25 | 2.96 | 2.19 | 1.97 | 1.65 | 1.46 |
| Dependability 50% | % | 9.59 | 9.48 | 8.16 | 7.97 | 6.80 | 7.43 | 6.28 |
| Dependability 25% | % | 68.56 | 80.11 | 67.13 | 73.62 | 61.60 | 72.35 | 60.48 |
| Weighted Mean | % | 24.33 | 27.14 | 22.90 | 24.39 | 20.50 | 23.63 | 19.81 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 91.08 | 86.83 | 87.66 | 81.60 | 82.49 | 75.51 | 76.39 |
| Dependability 50% | % | 56.28 | 47.17 | 48.85 | 43.51 | 44.85 | 39.47 | 40.62 |
| Dependability 25% | % | 30.31 | 27.47 | 28.91 | 30.11 | 31.23 | 29.61 | 29.53 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 18.62 | 0.00 | 18.62 | 0.00 | 18.62 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 3.15 | 21.25 | 2.75 | 21.04 | 2.52 | 20.88 | 2.34 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 18.62 | 0.00 | 18.62 | 0.00 | 18.62 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 3.15 | 21.25 | 2.75 | 21.04 | 2.52 | 20.88 | 2.34 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 72.81 | 83.09 | 70.13 | 104.54 | 87.87 | 125.20 | 104.95 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 8.96 | 9.99 | 8.43 | 9.66 | 8.12 | 9.36 | 7.84 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 14.96 | 13.89 | 14.15 | 13.44 | 13.67 | 13.04 | 13.24 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 85.05 | 86.63 | -1.58 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 85.05 | 86.63 | -1.58 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 548.27 | 462.17 | 86.10 |
| 5. Total Project Costs | Mill.Rs. | | 130.93 | 16.64 | 114.29 |
| 6. Project Capital Costs | Mill.Rs. | | 115.02 | 0.00 | 115.02 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 130.93 | 16.64 | 114.29 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 115.02 | 0.00 | 115.02 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 417.34 | 445.53 | -28.19 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.54 | 0.19 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 9793 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.78 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.75** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Dheel Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Sawai Madhopur | Name(s): | |
| Groundwater Potential Zone (PZ) | Sawaimadhopur,Bonli | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 689 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 18.79 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.32 | 0.65 | 0.65 | 0.83 | 0.83 | 0.90 | 0.90 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.10 | 0.11 | 0.11 | 0.12 | 0.12 | 0.14 | 0.14 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 5,943 | 5,943 | 5,943 | 5,943 | 5,943 | 5,943 | 5,943 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 7.61 | | | | | | |
| 2010 Irrigated Area | | ha | 1763 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 48.10 | 48.10 | 48.10 | 48.10 | 48.10 | 48.10 | 48.10 |
| | Dependability 90% | $Mm^3/yr$ | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |
| | Dependability 75% | $Mm^3/yr$ | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| | Dependability 50% | $Mm^3/yr$ | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| | Dependability 25% | $Mm^3/yr$ | 73.80 | 73.80 | 73.80 | 73.80 | 73.80 | 73.80 | 73.80 |
| | Weighted Mean | $Mm^3/yr$ | 30.36 | 30.36 | 30.36 | 30.36 | 30.36 | 30.36 | 30.36 |
| Losses from Reservoir | Annual | % | 11.71 | | | | | | |
| | During the Rabi Season | % | 5.52 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.09 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.90 | 0.90 | 2.71 | 2.71 | 4.51 | 4.51 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 18.79 | 17.89 | 17.89 | 16.08 | 16.08 | 14.28 | 14.28 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 11.09 | 10.58 | 10.58 | 9.58 | 9.58 | 8.57 | 8.57 |
| Dependability 90% | $Mm^3/yr$ | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 |
| Dependability 75% | $Mm^3/yr$ | 2.36 | 2.36 | 2.36 | 2.36 | 2.36 | 2.36 | 2.36 |
| Dependability 50% | $Mm^3/yr$ | 17.75 | 16.90 | 16.90 | 15.19 | 15.19 | 13.49 | 13.49 |
| Dependability 25% | $Mm^3/yr$ | 17.75 | 16.90 | 16.90 | 15.19 | 15.19 | 13.49 | 13.49 |
| On-Farm Irrigation Efficiency | % | 57.08 | 70.00 | 57.08 | 70.00 | 57.08 | 70.00 | 57.08 |
| Off-Farm Irrigation Efficiency | % | 57.80 | 72.00 | 57.80 | 72.00 | 57.80 | 72.00 | 57.80 |
| Present Overall Irrigation Efficiency | % | 32.99 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 6.41 | 7.62 | 6.12 | 6.90 | 5.54 | 6.17 | 4.95 |
| Dependability 90% | $Mm^3/yr$ | 0.22 | 0.27 | 0.22 | 0.27 | 0.22 | 0.27 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 1.37 | 1.70 | 1.37 | 1.70 | 1.37 | 1.70 | 1.37 |
| Dependability 50% | $Mm^3/yr$ | 10.26 | 12.17 | 9.77 | 10.94 | 8.78 | 9.71 | 7.80 |
| Dependability 25% | $Mm^3/yr$ | 10.26 | 12.17 | 9.77 | 10.94 | 8.78 | 9.71 | 7.80 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 108 | 128 | 103 | 116 | 93 | 104 | 83 |
| Dependability 90% | mm/yr | 4 | 5 | 4 | 5 | 4 | 5 | 4 |
| Dependability 75% | mm/yr | 23 | 29 | 23 | 29 | 23 | 29 | 23 |
| Dependability 50% | mm/yr | 173 | 205 | 164 | 184 | 148 | 163 | 131 |
| Dependability 25% | mm/yr | 173 | 205 | 164 | 184 | 148 | 163 | 131 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 4.44 | 4.23 | 4.23 | 3.80 | 3.80 | 3.37 | 3.37 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 18.63 | 19.16 | 19.16 | 20.23 | 20.23 | 21.29 | 21.29 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 1.21 | 2.11 | 2.11 | 3.92 | 3.92 | 5.72 | 5.72 |
| Dependability 25% | $Mm^3/yr$ | 55.01 | 55.91 | 55.91 | 57.72 | 57.72 | 59.52 | 59.52 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.61 | 1.61 | 1.61 | 1.61 | 1.61 | 1.61 | 1.61 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 46.91 | | 46.91 | | 46.91 | | 46.91 |
| Weighted Mean | $Mm^3/yr$ | 5.20 | 3.81 | 4.96 | 3.45 | 4.49 | 3.09 | 4.02 |
| Dependability 90% | $Mm^3/yr$ | 0.18 | 0.14 | 0.18 | 0.14 | 0.18 | 0.14 | 0.18 |
| Dependability 75% | $Mm^3/yr$ | 1.11 | 0.85 | 1.11 | 0.85 | 1.11 | 0.85 | 1.11 |
| Dependability 50% | $Mm^3/yr$ | 8.33 | 6.08 | 7.93 | 5.47 | 7.13 | 4.86 | 6.33 |
| Dependability 25% | $Mm^3/yr$ | 8.33 | 6.08 | 7.93 | 5.47 | 7.13 | 4.86 | 6.33 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.36 | 0.17 | 0.26 | 0.13 | 0.20 | 0.11 | 0.17 |
| Dependability 90% | $Mm^3/yr$ | 0.36 | 0.17 | 0.26 | 0.13 | 0.20 | 0.11 | 0.17 |
| Dependability 75% | $Mm^3/yr$ | 0.36 | 0.17 | 0.26 | 0.13 | 0.20 | 0.11 | 0.17 |
| Dependability 50% | $Mm^3/yr$ | 0.36 | 0.17 | 0.26 | 0.13 | 0.20 | 0.11 | 0.17 |
| Dependability 25% | $Mm^3/yr$ | 0.36 | 0.17 | 0.26 | 0.13 | 0.20 | 0.11 | 0.17 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 5.56 | 3.98 | 5.22 | 3.58 | 4.69 | 3.20 | 4.19 |
| Dependability 90% | $Mm^3/yr$ | 0.53 | 0.31 | 0.43 | 0.27 | 0.38 | 0.25 | 0.35 |
| Dependability 75% | $Mm^3/yr$ | 1.46 | 1.02 | 1.36 | 0.98 | 1.31 | 0.96 | 1.28 |
| Dependability 50% | $Mm^3/yr$ | 8.68 | 6.25 | 8.18 | 5.60 | 7.33 | 4.97 | 6.50 |
| Dependability 25% | $Mm^3/yr$ | 8.68 | 6.25 | 8.18 | 5.60 | 7.33 | 4.97 | 6.50 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.04 | 0.07 | 0.07 | 0.09 | 0.09 | 0.09 | 0.09 |
| Dependability 90% | $Mm^3/yr$ | 0.04 | 0.07 | 0.07 | 0.09 | 0.09 | 0.09 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.04 | 0.07 | 0.07 | 0.09 | 0.09 | 0.09 | 0.09 |
| Dependability 50% | $Mm^3/yr$ | 0.04 | 0.07 | 0.07 | 0.09 | 0.09 | 0.09 | 0.09 |
| Dependability 25% | $Mm^3/yr$ | 0.04 | 0.07 | 0.07 | 0.09 | 0.09 | 0.09 | 0.09 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 5.60 | 4.05 | 5.29 | 3.67 | 4.78 | 3.29 | 4.29 |
| Dependability 90% | $Mm^3/yr$ | 0.57 | 0.38 | 0.50 | 0.35 | 0.46 | 0.34 | 0.44 |
| Dependability 75% | $Mm^3/yr$ | 1.50 | 1.09 | 1.43 | 1.07 | 1.39 | 1.06 | 1.37 |
| Dependability 50% | $Mm^3/yr$ | 8.72 | 6.32 | 8.25 | 5.69 | 7.41 | 5.06 | 6.59 |
| Dependability 25% | $Mm^3/yr$ | 8.72 | 6.32 | 8.25 | 5.69 | 7.41 | 5.06 | 6.59 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 6.79 | 4.90 | 6.14 | 4.33 | 5.44 | 3.86 | 4.86 |
| Dependability 90% | $Mm^3/yr$ | 1.76 | 1.23 | 1.35 | 1.01 | 1.12 | 0.91 | 1.01 |
| Dependability 75% | $Mm^3/yr$ | 2.69 | 1.94 | 2.28 | 1.73 | 2.05 | 1.63 | 1.94 |
| Dependability 50% | $Mm^3/yr$ | 9.91 | 7.17 | 9.10 | 6.35 | 8.07 | 5.63 | 7.16 |
| Dependability 25% | $Mm^3/yr$ | 9.91 | 7.17 | 9.10 | 6.35 | 8.07 | 5.63 | 7.16 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 6.79 | 4.90 | 6.14 | 4.33 | 5.44 | 3.86 | 4.86 |
| Dependability 90% | $Mm^3/yr$ | 1.76 | 1.23 | 1.35 | 1.01 | 1.12 | 0.91 | 1.01 |
| Dependability 75% | $Mm^3/yr$ | 2.69 | 1.94 | 2.28 | 1.73 | 2.05 | 1.63 | 1.94 |
| Dependability 50% | $Mm^3/yr$ | 9.91 | 7.17 | 9.10 | 6.35 | 8.07 | 5.63 | 7.16 |
| Dependability 25% | $Mm^3/yr$ | 9.91 | 7.17 | 9.10 | 6.35 | 8.07 | 5.63 | 7.16 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 114 | 82 | 103 | 73 | 91 | 65 | 82 |
| | Dependability 90% | mm/yr | 30 | 21 | 23 | 17 | 19 | 15 | 17 |
| | Dependability 75% | mm/yr | 45 | 33 | 38 | 29 | 35 | 27 | 33 |
| | Dependability 50% | mm/yr | 167 | 121 | 153 | 107 | 136 | 95 | 121 |
| | Dependability 25% | mm/yr | 167 | 121 | 153 | 107 | 136 | 95 | 121 |
| Well Yield | | $10^3 m^3/yr$ | 15 | | | | | | |
| No. of Irrigation Wells | Existing | | 710 | 710 | 710 | 710 | 710 | 710 | 710 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 13.19 | 12.52 | 12.26 | 11.22 | 10.97 | 10.04 | 9.81 |
| | Dependability 90% | $Mm^3/yr$ | 1.98 | 1.50 | 1.57 | 1.29 | 1.34 | 1.19 | 1.23 |
| | Dependability 75% | $Mm^3/yr$ | 4.06 | 3.64 | 3.65 | 3.43 | 3.42 | 3.33 | 3.31 |
| | Dependability 50% | $Mm^3/yr$ | 20.17 | 19.34 | 18.87 | 17.29 | 16.85 | 15.35 | 14.96 |
| | Dependability 25% | $Mm^3/yr$ | 20.17 | 19.34 | 18.87 | 17.29 | 16.85 | 15.35 | 14.96 |
| Depth | ted Mean | mm/yr | 222 | 211 | 206 | 189 | 185 | 169 | 165 |
| | Dependability 90% | mm/yr | 33 | 25 | 26 | 22 | 23 | 20 | 21 |
| | Dependability 75% | mm/yr | 68 | 61 | 61 | 58 | 58 | 56 | 56 |
| | Dependability 50% | mm/yr | 339 | 325 | 317 | 291 | 284 | 258 | 252 |
| | Dependability 25% | mm/yr | 339 | 325 | 317 | 291 | 284 | 258 | 252 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 14600 | | | | | | |
| | Total | Mill.Rs. | | 86.77 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 86.77 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.54 | | | | | | |
| Average Annual Cost | Mill.Rs | 3.66 | 2.65 | 3.31 | 2.34 | 2.94 | 2.09 | 2.62 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 3.66 | 2.65 | 3.31 | 2.34 | 2.94 | 2.09 | 2.62 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 3.66 | 2.65 | 3.31 | 2.34 | 2.94 | 2.09 | 2.62 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.179 | 0.231 | 0.257 | 0.333 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Dheel Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Sawai Madhopur |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.179 | 0.231 | 0.257 | 0.333 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 5943 | 5943 | 5943 | 5943 | 5943 | 5943 | 5943 |
| SW On-Farm Irrigation Efficiency | % | 57.08 | 70.00 | 57.08 | 70.00 | 57.08 | 70.00 | 57.08 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.22 | 0.27 | 0.22 | 0.27 | 0.22 | 0.27 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 1.37 | 1.70 | 1.37 | 1.70 | 1.37 | 1.70 | 1.37 |
| Dependability 50% | $Mm^3/yr$ | 10.26 | 12.17 | 9.77 | 10.94 | 8.78 | 9.71 | 7.80 |
| Dependability 25% | $Mm^3/yr$ | 10.26 | 12.17 | 9.77 | 10.94 | 8.78 | 9.71 | 7.80 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.76 | 1.23 | 1.35 | 1.01 | 1.12 | 0.91 | 1.01 |
| Dependability 75% | $Mm^3/yr$ | 2.69 | 1.94 | 2.28 | 1.73 | 2.05 | 1.63 | 1.94 |
| Dependability 50% | $Mm^3/yr$ | 9.91 | 7.17 | 9.10 | 6.35 | 8.07 | 5.63 | 7.16 |
| Dependability 25% | $Mm^3/yr$ | 9.91 | 7.17 | 9.10 | 6.35 | 8.07 | 5.63 | 7.16 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.76 | 1.23 | 1.35 | 1.01 | 1.12 | 0.91 | 1.01 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 62.01 | 71.03 | 58.99 | 67.43 | 55.92 | 66.76 | 55.35 |
| CMLP Irrig. Intensity Dependability 90% | % | 7.48 | 6.53 | 5.91 | 5.09 | 4.57 | 4.70 | 4.20 |
| Dependability 75% | % | 14.95 | 15.63 | 13.37 | 14.69 | 12.49 | 12.97 | 10.98 |
| Dependability 50% | % | 73.09 | 82.58 | 68.29 | 73.80 | 60.96 | 59.59 | 49.22 |
| Dependability 25% | % | 73.45 | 82.98 | 68.62 | 74.16 | 61.26 | 59.79 | 49.39 |
| Weighted Mean | % | 48.03 | 53.64 | 44.54 | 47.97 | 39.77 | 39.06 | 32.38 |
| CMLP GW Use Dependability 90% | % | 88.97 | 81.83 | 86.08 | 78.85 | 83.70 | 77.07 | 82.26 |
| Dependability 75% | % | 65.82 | 52.24 | 61.89 | 49.27 | 59.29 | 47.74 | 57.94 |
| Dependability 50% | % | 46.14 | 32.86 | 43.61 | 32.46 | 44.79 | 32.48 | 44.79 |
| Dependability 25% | % | 45.05 | 31.32 | 44.04 | 28.82 | 43.66 | 30.97 | 43.69 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 9.57 | 0.00 | 9.57 | 0.00 | 9.57 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 3.66 | 12.22 | 3.31 | 11.91 | 2.94 | 11.66 | 2.62 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 9.57 | 0.00 | 9.57 | 0.00 | 9.57 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 3.66 | 12.22 | 3.31 | 11.91 | 2.94 | 11.66 | 2.62 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 62.01 | 71.03 | 58.99 | 67.43 | 55.92 | 66.76 | 55.35 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 8.07 | 9.01 | 7.48 | 8.07 | 6.69 | 7.22 | 5.98 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 13.19 | 12.52 | 12.26 | 11.22 | 10.97 | 10.04 | 9.81 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 75.22 | 73.62 | 1.60 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 75.22 | 73.62 | 1.60 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 433.33 | 359.75 | 73.58 |
| 5. Total Project Costs | Mill.Rs. | | 74.98 | 19.86 | 55.12 |
| 6. Project Capital Costs | Mill.Rs. | | 59.14 | 0.00 | 59.14 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 74.98 | 19.86 | 55.12 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 59.14 | 0.00 | 59.14 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 358.35 | 339.88 | 18.47 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.00 | 0.27 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 9950 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.25 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **1.31** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Dindoli Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | 3019 | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | CHITTORGARH | Name(s): | |
| Groundwater Potential Zone (PZ) | KAPASON,RASHMI | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 20.72 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 7.39 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.10 | 0.21 | 0.21 | 0.26 | 0.26 | 0.28 | 0.28 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.11 | 0.12 | 0.12 | 0.14 | 0.14 | 0.15 | 0.15 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 2,056 | 2,056 | 2,056 | 2,056 | 2,056 | 2,056 | 2,056 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 4.34 | | | | | | |
| 2010 Irrigated Area | | ha | 623 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 |
| | Dependability 90% | $Mm^3/yr$ | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| | Dependability 75% | $Mm^3/yr$ | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| | Dependability 50% | $Mm^3/yr$ | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 |
| | Dependability 25% | $Mm^3/yr$ | 3.60 | 3.60 | 3.60 | 3.60 | 3.60 | 3.60 | 3.60 |
| | Weighted Mean | $Mm^3/yr$ | 2.17 | 2.17 | 2.17 | 2.17 | 2.17 | 2.17 | 2.17 |
| Losses from Reservoir | Annual | % | 14.85 | | | | | | |
| | During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.00 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.03 | 0.03 | 0.08 | 0.08 | 0.14 | 0.14 |
| - Part of Siltation in Dead Storage | | % | 100 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 7.39 | 7.36 | 7.36 | 7.31 | 7.31 | 7.25 | 7.25 |
| Import: | Mean | $Mm^3/yr$ | 4.57 | 4.57 | 4.57 | 4.57 | 4.57 | 4.57 | 4.57 |
| | Dependability 90% | $Mm^3/yr$ | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| | Dependability 75% | $Mm^3/yr$ | 2.66 | 2.66 | 2.66 | 2.66 | 2.66 | 2.66 | 2.66 |
| | Dependability 50% | $Mm^3/yr$ | 4.81 | 4.81 | 4.81 | 4.81 | 4.81 | 4.81 | 4.81 |
| | Dependability 25% | $Mm^3/yr$ | 6.28 | 6.28 | 6.28 | 6.28 | 6.28 | 6.28 | 6.28 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 5.07 | 5.06 | 5.06 | 5.04 | 5.04 | 5.02 | 5.02 |
| Dependability 90% | $Mm^3/yr$ | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| Dependability 75% | $Mm^3/yr$ | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 |
| Dependability 50% | $Mm^3/yr$ | 6.69 | 6.69 | 6.69 | 6.69 | 6.69 | 6.69 | 6.69 |
| Dependability 25% | $Mm^3/yr$ | 6.85 | 6.83 | 6.83 | 6.78 | 6.78 | 6.73 | 6.73 |
| On-Farm Irrigation Efficiency | % | 24.07 | 70.00 | 24.07 | 70.00 | 24.07 | 70.00 | 24.07 |
| Off-Farm Irrigation Efficiency | % | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 |
| Present Overall Irrigation Efficiency | % | 13.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 2.74 | 3.65 | 2.73 | 3.63 | 2.72 | 3.62 | 2.71 |
| Dependability 90% | $Mm^3/yr$ | 0.70 | 0.93 | 0.70 | 0.93 | 0.70 | 0.93 | 0.70 |
| Dependability 75% | $Mm^3/yr$ | 1.73 | 2.31 | 1.73 | 2.31 | 1.73 | 2.31 | 1.73 |
| Dependability 50% | $Mm^3/yr$ | 3.61 | 4.81 | 3.61 | 4.81 | 3.61 | 4.81 | 3.61 |
| Dependability 25% | $Mm^3/yr$ | 3.70 | 4.92 | 3.69 | 4.88 | 3.66 | 4.84 | 3.63 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 133 | 177 | 133 | 177 | 132 | 176 | 132 |
| Dependability 90% | mm/yr | 34 | 45 | 34 | 45 | 34 | 45 | 34 |
| Dependability 75% | mm/yr | 84 | 112 | 84 | 112 | 84 | 112 | 84 |
| Dependability 50% | mm/yr | 176 | 234 | 176 | 234 | 176 | 234 | 176 |
| Dependability 25% | mm/yr | 180 | 239 | 179 | 237 | 178 | 236 | 177 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 1.71 | 1.71 | 1.71 | 1.69 | 1.69 | 1.68 | 1.68 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 1.02 | 1.03 | 1.03 | 1.05 | 1.05 | 1.08 | 1.08 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 2.49 | 2.52 | 2.52 | 2.57 | 2.57 | 2.63 | 2.63 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 60.90 | | 60.90 | | 60.90 | | 60.90 |
| Weighted Mean | $Mm^3/yr$ | 3.09 | 1.82 | 3.08 | 1.82 | 3.07 | 1.81 | 3.06 |
| Dependability 90% | $Mm^3/yr$ | 0.79 | 0.47 | 0.79 | 0.47 | 0.79 | 0.47 | 0.79 |
| Dependability 75% | $Mm^3/yr$ | 1.95 | 1.16 | 1.95 | 1.16 | 1.95 | 1.16 | 1.95 |
| Dependability 50% | $Mm^3/yr$ | 4.07 | 2.41 | 4.07 | 2.41 | 4.07 | 2.41 | 4.07 |
| Dependability 25% | $Mm^3/yr$ | 4.17 | 2.46 | 4.16 | 2.44 | 4.13 | 2.42 | 4.10 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.10 | 0.04 | 0.06 | 0.03 | 0.04 | 0.02 | 0.03 |
| Dependability 90% | $Mm^3/yr$ | 0.10 | 0.04 | 0.06 | 0.03 | 0.04 | 0.02 | 0.03 |
| Dependability 75% | $Mm^3/yr$ | 0.10 | 0.04 | 0.06 | 0.03 | 0.04 | 0.02 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.10 | 0.04 | 0.06 | 0.03 | 0.04 | 0.02 | 0.03 |
| Dependability 25% | $Mm^3/yr$ | 0.10 | 0.04 | 0.06 | 0.03 | 0.04 | 0.02 | 0.03 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 3.19 | 1.86 | 3.15 | 1.84 | 3.11 | 1.83 | 3.09 |
| Dependability 90% | $Mm^3/yr$ | 0.89 | 0.51 | 0.85 | 0.50 | 0.83 | 0.49 | 0.82 |
| Dependability 75% | $Mm^3/yr$ | 2.05 | 1.20 | 2.02 | 1.18 | 2.00 | 1.18 | 1.99 |
| Dependability 50% | $Mm^3/yr$ | 4.17 | 2.45 | 4.14 | 2.44 | 4.11 | 2.43 | 4.11 |
| Dependability 25% | $Mm^3/yr$ | 4.27 | 2.50 | 4.22 | 2.47 | 4.17 | 2.44 | 4.13 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 90% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 50% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 25% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 3.21 | 1.89 | 3.18 | 1.88 | 3.15 | 1.87 | 3.13 |
| Dependability 90% | $Mm^3/yr$ | 0.91 | 0.54 | 0.88 | 0.53 | 0.87 | 0.53 | 0.86 |
| Dependability 75% | $Mm^3/yr$ | 2.07 | 1.23 | 2.05 | 1.22 | 2.03 | 1.22 | 2.03 |
| Dependability 50% | $Mm^3/yr$ | 4.19 | 2.48 | 4.17 | 2.47 | 4.15 | 2.47 | 4.14 |
| Dependability 25% | $Mm^3/yr$ | 4.29 | 2.53 | 4.25 | 2.50 | 4.21 | 2.48 | 4.17 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 3.54 | 2.10 | 3.39 | 2.02 | 3.29 | 1.98 | 3.24 |
| Dependability 90% | $Mm^3/yr$ | 1.24 | 0.75 | 1.09 | 0.67 | 1.01 | 0.64 | 0.97 |
| Dependability 75% | $Mm^3/yr$ | 2.41 | 1.44 | 2.26 | 1.36 | 2.17 | 1.33 | 2.14 |
| Dependability 50% | $Mm^3/yr$ | 4.53 | 2.69 | 4.38 | 2.61 | 4.29 | 2.58 | 4.25 |
| Dependability 25% | $Mm^3/yr$ | 4.63 | 2.74 | 4.46 | 2.64 | 4.35 | 2.59 | 4.28 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 3.54 | 2.10 | 3.39 | 2.02 | 3.29 | 1.98 | 3.24 |
| Dependability 90% | $Mm^3/yr$ | 1.24 | 0.75 | 1.09 | 0.67 | 1.01 | 0.64 | 0.97 |
| Dependability 75% | $Mm^3/yr$ | 2.41 | 1.44 | 2.26 | 1.36 | 2.17 | 1.33 | 2.14 |
| Dependability 50% | $Mm^3/yr$ | 4.53 | 2.69 | 4.38 | 2.61 | 4.29 | 2.58 | 4.25 |
| Dependability 25% | $Mm^3/yr$ | 4.63 | 2.74 | 4.46 | 2.64 | 4.35 | 2.59 | 4.28 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 172 | 102 | 165 | 98 | 160 | 96 | 158 |
| | Dependability 90% | mm/yr | 61 | 36 | 53 | 33 | 49 | 31 | 47 |
| | Dependability 75% | mm/yr | 117 | 70 | 110 | 66 | 106 | 65 | 104 |
| | Dependability 50% | mm/yr | 220 | 131 | 213 | 127 | 209 | 125 | 207 |
| | Dependability 25% | mm/yr | 225 | 133 | 217 | 129 | 211 | 126 | 208 |
| Well Yield | | $10^3 m^3/yr$ | 16 | | | | | | |
| No. of Irrigation Wells | Existing | | 373 | 373 | 373 | 373 | 373 | 373 | 373 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 6.11 | 6.11 | 6.11 | 6.11 | 6.11 | 6.11 | 6.11 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 6.28 | 5.75 | 6.12 | 5.65 | 6.01 | 5.60 | 5.95 |
| | Dependability 90% | $Mm^3/yr$ | 1.95 | 1.68 | 1.79 | 1.61 | 1.71 | 1.57 | 1.67 |
| | Dependability 75% | $Mm^3/yr$ | 4.14 | 3.75 | 3.99 | 3.67 | 3.91 | 3.64 | 3.87 |
| | Dependability 50% | $Mm^3/yr$ | 8.14 | 7.50 | 7.99 | 7.43 | 7.90 | 7.39 | 7.86 |
| | Dependability 25% | $Mm^3/yr$ | 8.33 | 7.66 | 8.15 | 7.52 | 8.01 | 7.44 | 7.91 |
| Depth | ted Mean | mm/yr | 306 | 280 | 298 | 275 | 292 | 272 | 290 |
| | Dependability 90% | mm/yr | 95 | 82 | 87 | 78 | 83 | 77 | 81 |
| | Dependability 75% | mm/yr | 201 | 182 | 194 | 178 | 190 | 177 | 188 |
| | Dependability 50% | mm/yr | 396 | 365 | 388 | 361 | 384 | 360 | 383 |
| | Dependability 25% | mm/yr | 405 | 372 | 396 | 366 | 389 | 362 | 385 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 10486 | | | | | | |
| | Total | Mill.Rs. | | 21.56 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 21.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.61 | | | | | | |
| Average Annual Cost | Mill.Rs | 2.16 | 1.28 | 2.07 | 1.23 | 2.01 | 1.21 | 1.98 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 2.16 | 1.28 | 2.07 | 1.23 | 2.01 | 1.21 | 1.98 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 2.16 | 1.28 | 2.07 | 1.23 | 2.01 | 1.21 | 1.98 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.179 | 0.206 | 0.205 | 0.410 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Dindoli Irrigation Project |
| WRIS Project Code: | 3019 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | CHITTORGARH |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.179 | 0.206 | 0.205 | 0.41 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| . | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 2056 | 2056 | 2056 | 2056 | 2056 | 2056 | 2056 |
| SW On-Farm Irrigation Efficiency | % | 24.07 | 70.00 | 24.07 | 70.00 | 24.07 | 70.00 | 24.07 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.70 | 0.93 | 0.70 | 0.93 | 0.70 | 0.93 | 0.70 |
| Dependability 75% | $Mm^3/yr$ | 1.73 | 2.31 | 1.73 | 2.31 | 1.73 | 2.31 | 1.73 |
| Dependability 50% | $Mm^3/yr$ | 3.61 | 4.81 | 3.61 | 4.81 | 3.61 | 4.81 | 3.61 |
| Dependability 25% | $Mm^3/yr$ | 3.70 | 4.92 | 3.69 | 4.88 | 3.66 | 4.84 | 3.63 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.24 | 0.75 | 1.09 | 0.67 | 1.01 | 0.64 | 0.97 |
| Dependability 75% | $Mm^3/yr$ | 2.41 | 1.44 | 2.26 | 1.36 | 2.17 | 1.33 | 2.14 |
| Dependability 50% | $Mm^3/yr$ | 4.53 | 2.69 | 4.38 | 2.61 | 4.29 | 2.58 | 4.25 |
| Dependability 25% | $Mm^3/yr$ | 4.63 | 2.74 | 4.46 | 2.64 | 4.35 | 2.59 | 4.28 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.24 | 0.75 | 1.09 | 0.67 | 1.01 | 0.64 | 0.97 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 6.11 | 6.11 | 6.11 | 6.11 | 6.11 | 6.11 | 6.11 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 18.98 | 27.32 | 18.91 | 31.51 | 21.70 | 34.80 | 23.91 |
| CMLP Irrig. Intensity Dependability 90% | % | 14.48 | 18.23 | 13.19 | 17.24 | 12.27 | 16.87 | 11.92 |
| Dependability 75% | % | 29.42 | 40.50 | 28.31 | 39.34 | 27.29 | 38.97 | 26.94 |
| Dependability 50% | % | 56.80 | 81.32 | 56.05 | 79.87 | 54.83 | 79.49 | 54.47 |
| Dependability 25% | % | 58.30 | 83.25 | 57.37 | 81.19 | 55.73 | 80.23 | 54.98 |
| Weighted Mean | % | 44.20 | 62.41 | 43.21 | 60.85 | 41.91 | 60.24 | 41.39 |
| CMLP GW Use Dependability 90% | % | 63.97 | 44.50 | 60.94 | 41.82 | 59.00 | 40.58 | 58.12 |
| Dependability 75% | % | 57.58 | 36.63 | 55.45 | 35.29 | 55.05 | 34.70 | 54.62 |
| Dependability 50% | % | 53.71 | 30.39 | 52.96 | 29.69 | 52.46 | 29.37 | 52.23 |
| Dependability 25% | % | 53.27 | 29.37 | 52.60 | 28.70 | 52.12 | 28.39 | 51.90 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 2.38 | 0.00 | 2.38 | 0.00 | 2.38 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 2.16 | 3.66 | 2.07 | 3.61 | 2.01 | 3.59 | 1.98 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 2.38 | 0.00 | 2.38 | 0.00 | 2.38 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 2.16 | 3.66 | 2.07 | 3.61 | 2.01 | 3.59 | 1.98 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 18.98 | 27.32 | 18.91 | 31.51 | 21.70 | 34.80 | 23.91 |
| Wtd.Mean net Irrigation water supply | $Mm^3$/yr | 2.96 | 4.13 | 2.86 | 4.06 | 2.79 | 4.02 | 2.76 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3$/yr | 6.28 | 5.75 | 6.12 | 5.65 | 6.01 | 5.60 | 5.95 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3$/yr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 35.36 | 37.64 | -2.27 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 35.36 | 37.64 | -2.27 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 175.44 | 121.27 | 54.16 |
| 5. Total Project Costs | Mill.Rs. | | 22.54 | 12.67 | 9.87 |
| 6. Project Capital Costs | Mill.Rs. | | 14.69 | 0.00 | 14.69 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 22.54 | 12.67 | 9.87 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 14.69 | 0.00 | 14.69 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 152.89 | 108.61 | 44.29 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.64 | 0.34 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7146 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.96 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **4.01** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

# Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Dugari Irrigation Project**

## I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | 02693 | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Chambal | Linked to Project(s): | |
| District | Bundi | Name(s): | |
| Groundwater Potential Zone (PZ) | Nainwa, | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 106.3 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 16.81 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

## II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | 3.76 | 3.76 | 3.76 | 3.76 | 3.76 | 3.76 | 3.76 |
| | From GW | $Mm^3/yr$ | 0.07 | 0.14 | 0.14 | 0.17 | 0.17 | 0.18 | 0.18 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.05 | 0.05 | 0.05 | 0.07 | 0.07 | 0.07 | 0.07 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 2,251 | 2,251 | 2,251 | 2,251 | 2,251 | 2,251 | 2,251 |
| 2011 Irrigation (Gross) | | $Mm^3/yr$ | 12.41 | | | | | | |
| 2011Irrigated Area | | ha | 1092 | | | | | | |

## III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 9.36 | 9.36 | 9.36 | 9.36 | 9.36 | 9.36 | 9.36 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 |
| Dependability 50% | $Mm^3/yr$ | 3.56 | 3.56 | 3.56 | 3.56 | 3.56 | 3.56 | 3.56 |
| Dependability 25% | $Mm^3/yr$ | 14.67 | 14.67 | 14.67 | 14.67 | 14.67 | 14.67 | 14.67 |
| Weighted Mean | $Mm^3/yr$ | 6.14 | 6.14 | 6.14 | 6.14 | 6.14 | 6.14 | 6.14 |
| Losses from Reservoir Annual | % | 16.21 | | | | | | |
| During the Rabi Season | % | 7.42 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 218.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.02 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.23 | 0.23 | 0.70 | 0.70 | 1.16 | 1.16 |
| - Part of Siltation in Dead Storage | % | 0 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 16.81 | 16.58 | 16.58 | 16.11 | 16.11 | 15.65 | 15.65 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 3.39 | 3.39 | 3.39 | 3.39 | 3.39 | 3.39 | 3.39 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 |
| On-Farm Irrigation Efficiency | % | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 |
| Off-Farm Irrigation Efficiency | % | 42.60 | 72.00 | 42.60 | 72.00 | 42.60 | 72.00 | 42.60 |
| Present Overall Irrigation Efficiency | % | 24.28 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 1.45 | 2.44 | 1.45 | 2.44 | 1.45 | 2.44 | 1.45 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 4.02 | 6.79 | 4.02 | 6.79 | 4.02 | 6.79 | 4.02 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 64 | 109 | 64 | 109 | 64 | 109 | 64 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 50% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 25% | mm/yr | 178 | 302 | 178 | 302 | 178 | 302 | 178 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.36 | 2.36 | 2.36 | 2.36 | 2.36 | 2.36 | 2.36 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |
| Dependability 50% | $Mm^3/yr$ | 2.98 | 2.98 | 2.98 | 2.98 | 2.98 | 2.98 | 2.98 |
| Dependability 25% | $Mm^3/yr$ | 3.76 | 3.76 | 3.76 | 3.76 | 3.76 | 3.76 | 3.76 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 0.68 | 0.68 | 0.68 | 0.68 | 0.68 | 0.68 | 0.68 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 53.00 | | 53.00 | | 53.00 | | 53.00 |
| Weighted Mean | $Mm^3/yr$ | 1.80 | 1.22 | 1.80 | 1.22 | 1.80 | 1.22 | 1.80 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 5.00 | 3.39 | 5.00 | 3.39 | 5.00 | 3.39 | 5.00 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Dependability 90% | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Dependability 75% | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Dependability 50% | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Dependability 25% | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 1.97 | 1.32 | 1.95 | 1.31 | 1.93 | 1.31 | 1.93 |
| Dependability 90% | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Dependability 75% | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Dependability 50% | $Mm^3/yr$ | 0.17 | 0.10 | 0.15 | 0.09 | 0.13 | 0.09 | 0.13 |
| Dependability 25% | $Mm^3/yr$ | 5.17 | 3.49 | 5.15 | 3.48 | 5.13 | 3.48 | 5.13 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.54 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 |
| Dependability 90% | $Mm^3/yr$ | 0.35 | 0.36 | 0.36 | 0.36 | 0.36 | 0.36 | 0.36 |
| Dependability 75% | $Mm^3/yr$ | 0.37 | 0.37 | 0.37 | 0.38 | 0.38 | 0.38 | 0.38 |
| Dependability 50% | $Mm^3/yr$ | 0.62 | 0.63 | 0.63 | 0.63 | 0.63 | 0.64 | 0.64 |
| Dependability 25% | $Mm^3/yr$ | 0.69 | 0.70 | 0.70 | 0.71 | 0.71 | 0.71 | 0.71 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 2.51 | 1.87 | 2.49 | 1.86 | 2.48 | 1.86 | 2.48 |
| Dependability 90% | $Mm^3/yr$ | 0.52 | 0.46 | 0.51 | 0.45 | 0.50 | 0.45 | 0.49 |
| Dependability 75% | $Mm^3/yr$ | 0.54 | 0.47 | 0.52 | 0.47 | 0.51 | 0.47 | 0.51 |
| Dependability 50% | $Mm^3/yr$ | 0.79 | 0.73 | 0.78 | 0.72 | 0.77 | 0.72 | 0.76 |
| Dependability 25% | $Mm^3/yr$ | 5.86 | 4.19 | 5.85 | 4.19 | 5.83 | 4.19 | 5.83 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 3.07 | 2.37 | 2.99 | 2.30 | 2.92 | 2.29 | 2.91 |
| Dependability 90% | $Mm^3/yr$ | 1.08 | 0.95 | 1.00 | 0.89 | 0.93 | 0.88 | 0.92 |
| Dependability 75% | $Mm^3/yr$ | 1.10 | 0.97 | 1.02 | 0.90 | 0.95 | 0.90 | 0.94 |
| Dependability 50% | $Mm^3/yr$ | 1.35 | 1.23 | 1.28 | 1.16 | 1.20 | 1.15 | 1.20 |
| Dependability 25% | $Mm^3/yr$ | 6.42 | 4.69 | 6.34 | 4.62 | 6.27 | 4.62 | 6.26 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 2.69 | 2.37 | 2.64 | 2.30 | 2.60 | 2.29 | 2.59 |
| Dependability 90% | $Mm^3/yr$ | 1.08 | 0.95 | 1.00 | 0.89 | 0.93 | 0.88 | 0.92 |
| Dependability 75% | $Mm^3/yr$ | 1.10 | 0.97 | 1.02 | 0.90 | 0.95 | 0.90 | 0.94 |
| Dependability 50% | $Mm^3/yr$ | 1.35 | 1.23 | 1.28 | 1.16 | 1.20 | 1.15 | 1.20 |
| Dependability 25% | $Mm^3/yr$ | 5.37 | 4.69 | 5.37 | 4.62 | 5.37 | 4.62 | 5.37 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 120 | 105 | 117 | 102 | 115 | 102 | 115 |
| | Dependability 90% | mm/yr | 48 | 42 | 45 | 40 | 41 | 39 | 41 |
| | Dependability 75% | mm/yr | 49 | 43 | 45 | 40 | 42 | 40 | 42 |
| | Dependability 50% | mm/yr | 60 | 54 | 57 | 52 | 54 | 51 | 53 |
| | Dependability 25% | mm/yr | 239 | 208 | 239 | 205 | 239 | 205 | 239 |
| Well Yield | | $10^3 m^3/yr$ | 19 | | | | | | |
| No. of Irrigation Wells | Existing | | 280 | 280 | 280 | 280 | 280 | 280 | 280 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.07 | 1.07 | 1.07 | 1.07 | 1.07 | 1.07 | 1.07 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 4.14 | 4.81 | 4.09 | 4.74 | 4.04 | 4.74 | 4.04 |
| | Dependability 90% | $Mm^3/yr$ | 1.08 | 0.95 | 1.00 | 0.89 | 0.93 | 0.88 | 0.92 |
| | Dependability 75% | $Mm^3/yr$ | 1.10 | 0.97 | 1.02 | 0.90 | 0.95 | 0.90 | 0.94 |
| | Dependability 50% | $Mm^3/yr$ | 1.35 | 1.23 | 1.28 | 1.16 | 1.20 | 1.15 | 1.20 |
| | Dependability 25% | $Mm^3/yr$ | 9.39 | 11.48 | 9.39 | 11.41 | 9.39 | 11.40 | 9.39 |
| Depth | ted Mean | mm/yr | 184 | 214 | 182 | 211 | 180 | 210 | 179 |
| | Dependability 90% | mm/yr | 48 | 42 | 45 | 40 | 41 | 39 | 41 |
| | Dependability 75% | mm/yr | 49 | 43 | 45 | 40 | 42 | 40 | 42 |
| | Dependability 50% | mm/yr | 60 | 54 | 57 | 52 | 54 | 51 | 53 |
| | Dependability 25% | mm/yr | 417 | 510 | 417 | 507 | 417 | 507 | 417 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11285 | | | | | | |
| | Total | Mill.Rs. | | 25.40 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 25.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.53 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.43 | 1.25 | 1.40 | 1.22 | 1.38 | 1.21 | 1.37 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.43 | 1.25 | 1.40 | 1.22 | 1.38 | 1.21 | 1.37 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 1.43 | 1.25 | 1.40 | 1.22 | 1.38 | 1.21 | 1.37 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.200 | 0.210 | 0.230 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Dugari Irrigation Project |
| WRIS Project Code: | 02693 |
| Status: | Existing |
| River Basin: | Chambal |
| Irrigation Demand Zone (IDZ) | Bundi |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.2 | 0.21 | 0.23 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 2251 | 2251 | 2251 | 2251 | 2251 | 2251 | 2251 |
| SW On-Farm Irrigation Efficiency | % | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 4.02 | 6.79 | 4.02 | 6.79 | 4.02 | 6.79 | 4.02 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.08 | 0.95 | 1.00 | 0.89 | 0.93 | 0.88 | 0.92 |
| Dependability 75% | $Mm^3/yr$ | 1.10 | 0.97 | 1.02 | 0.90 | 0.95 | 0.90 | 0.94 |
| Dependability 50% | $Mm^3/yr$ | 1.35 | 1.23 | 1.28 | 1.16 | 1.20 | 1.15 | 1.20 |
| Dependability 25% | $Mm^3/yr$ | 6.42 | 4.69 | 6.34 | 4.62 | 6.27 | 4.62 | 6.26 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.08 | 0.95 | 1.00 | 0.89 | 0.93 | 0.88 | 0.92 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.07 | 1.07 | 1.07 | 1.07 | 1.07 | 1.07 | 1.07 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 18.76 | 26.44 | 19.28 | 29.10 | 21.26 | 31.31 | 22.89 |
| CMLP Irrig. Intensity Dependability 90% | % | 10.78 | 10.74 | 9.79 | 10.00 | 9.09 | 9.50 | 8.64 |
| Dependability 75% | % | 10.95 | 10.93 | 9.96 | 10.19 | 9.26 | 9.68 | 8.80 |
| Dependability 50% | % | 13.59 | 13.90 | 12.54 | 13.16 | 11.84 | 11.37 | 10.22 |
| Dependability 25% | % | 89.55 | 125.45 | 87.67 | 124.71 | 87.67 | 108.32 | 76.20 |
| Weighted Mean | % | 39.82 | 52.80 | 38.50 | 52.06 | 38.05 | 45.54 | 33.36 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 50% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 25% | % | 54.26 | 36.29 | 54.33 | 35.92 | 53.11 | 39.19 | 56.06 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 2.80 | 0.00 | 2.80 | 0.00 | 2.80 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 1.43 | 4.06 | 1.40 | 4.02 | 1.38 | 4.02 | 1.37 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 2.80 | 0.00 | 2.80 | 0.00 | 2.80 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 1.43 | 4.06 | 1.40 | 4.02 | 1.38 | 4.02 | 1.37 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 18.76 | 26.44 | 19.28 | 29.10 | 21.26 | 31.31 | 22.89 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 2.57 | 3.48 | 2.54 | 3.44 | 2.51 | 3.43 | 2.51 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 4.14 | 4.81 | 4.09 | 4.74 | 4.04 | 4.74 | 4.04 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 42.41 | 37.98 | 4.43 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 29.60 | 25.18 | 4.43 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 12.80 | 12.80 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 167.59 | 122.26 | 45.34 |
| 5. Total Project Costs | Mill.Rs. | | 25.00 | 8.61 | 16.39 |
| 6. Project Capital Costs | Mill.Rs. | | 17.31 | 0.00 | 17.31 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 25.00 | 8.61 | 16.39 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 17.31 | 0.00 | 17.31 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 142.59 | 113.65 | 28.94 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.59 | 0.23 | |
| 2. Priority Sectors Use | % | | 30.19 | 33.71 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7691 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.16 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **2.67** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Galwania Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | CHAMBAL | Linked to Project(s): | |
| District | Tonk,Bundi,Sawaimadhopur | Name(s): | |
| Groundwater Potential Zone (PZ) | Keshorai Patan,Uniara,Khandar | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 69.5 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 10.93 | Code: | |
| Present Dead Storage, $Mm^3$ | 0.7452 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.10 | 0.19 | 0.19 | 0.23 | 0.23 | 0.26 | 0.26 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.10 | 0.10 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 2,257 | 2,257 | 2,257 | 2,257 | 2,257 | 2,257 | 2,257 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 10.37 | | | | | | |
| 2010 Irrigated Area | | ha | 2003 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 17.21 | 17.21 | 17.21 | 17.21 | 17.21 | 17.21 | 17.21 |
| | Dependability 90% | $Mm^3/yr$ | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 |
| | Dependability 75% | $Mm^3/yr$ | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 | 7.60 |
| | Dependability 50% | $Mm^3/yr$ | 16.66 | 16.66 | 16.66 | 16.66 | 16.66 | 16.66 | 16.66 |
| | Dependability 25% | $Mm^3/yr$ | 23.93 | 23.93 | 23.93 | 23.93 | 23.93 | 23.93 | 23.93 |
| | Weighted Mean | $Mm^3/yr$ | 14.95 | 14.95 | 14.95 | 14.95 | 14.95 | 14.95 | 14.95 |
| Losses from Reservoir | Annual | % | 24.82 | | | | | | |
| | During the Rabi Season | % | 10.93 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 218.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.02 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.15 | 0.15 | 0.45 | 0.45 | 0.76 | 0.76 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 10.93 | 10.85 | 10.85 | 10.68 | 10.68 | 10.51 | 10.51 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 8.01 | 7.96 | 7.96 | 7.86 | 7.86 | 7.76 | 7.76 |
| Dependability 90% | $Mm^3/yr$ | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 |
| Dependability 75% | $Mm^3/yr$ | 6.77 | 6.77 | 6.77 | 6.77 | 6.77 | 6.77 | 6.77 |
| Dependability 50% | $Mm^3/yr$ | 9.74 | 9.66 | 9.66 | 9.51 | 9.51 | 9.36 | 9.36 |
| Dependability 25% | $Mm^3/yr$ | 9.74 | 9.66 | 9.66 | 9.51 | 9.51 | 9.36 | 9.36 |
| On-Farm Irrigation Efficiency | % | 26.85 | 70.00 | 26.85 | 70.00 | 26.85 | 70.00 | 26.85 |
| Off-Farm Irrigation Efficiency | % | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 |
| Present Overall Irrigation Efficiency | % | 14.50 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 4.32 | 5.73 | 4.30 | 5.66 | 4.24 | 5.59 | 4.19 |
| Dependability 90% | $Mm^3/yr$ | 1.16 | 1.55 | 1.16 | 1.55 | 1.16 | 1.55 | 1.16 |
| Dependability 75% | $Mm^3/yr$ | 3.66 | 4.87 | 3.66 | 4.87 | 3.66 | 4.87 | 3.66 |
| Dependability 50% | $Mm^3/yr$ | 5.26 | 6.96 | 5.22 | 6.85 | 5.14 | 6.74 | 5.06 |
| Dependability 25% | $Mm^3/yr$ | 5.26 | 6.96 | 5.22 | 6.85 | 5.14 | 6.74 | 5.06 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 192 | 254 | 190 | 251 | 188 | 248 | 186 |
| Dependability 90% | mm/yr | 52 | 69 | 52 | 69 | 52 | 69 | 52 |
| Dependability 75% | mm/yr | 162 | 216 | 162 | 216 | 162 | 216 | 162 |
| Dependability 50% | mm/yr | 233 | 308 | 231 | 303 | 228 | 299 | 224 |
| Dependability 25% | mm/yr | 233 | 308 | 231 | 303 | 228 | 299 | 224 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.43 | 2.42 | 2.42 | 2.38 | 2.38 | 2.34 | 2.34 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 5.96 | 6.02 | 6.02 | 6.13 | 6.13 | 6.23 | 6.23 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 5.73 | 5.81 | 5.81 | 5.98 | 5.98 | 6.15 | 6.15 |
| Dependability 25% | $Mm^3/yr$ | 13.00 | 13.08 | 13.08 | 13.25 | 13.25 | 13.42 | 13.42 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.11 | 1.11 | 1.11 | 1.11 | 1.11 | 1.11 | 1.11 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 59.85 | | 59.85 | | 59.85 | | 59.85 |
| Weighted Mean | $Mm^3/yr$ | 4.79 | 2.86 | 4.76 | 2.83 | 4.70 | 2.80 | 4.65 |
| Dependability 90% | $Mm^3/yr$ | 1.29 | 0.78 | 1.29 | 0.78 | 1.29 | 0.78 | 1.29 |
| Dependability 75% | $Mm^3/yr$ | 4.05 | 2.44 | 4.05 | 2.44 | 4.05 | 2.44 | 4.05 |
| Dependability 50% | $Mm^3/yr$ | 5.83 | 3.48 | 5.78 | 3.42 | 5.69 | 3.37 | 5.60 |
| Dependability 25% | $Mm^3/yr$ | 5.83 | 3.48 | 5.78 | 3.42 | 5.69 | 3.37 | 5.60 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.28 | 0.17 | 0.25 | 0.16 | 0.24 | 0.15 | 0.23 |
| Dependability 90% | $Mm^3/yr$ | 0.28 | 0.17 | 0.25 | 0.16 | 0.24 | 0.15 | 0.23 |
| Dependability 75% | $Mm^3/yr$ | 0.28 | 0.17 | 0.25 | 0.16 | 0.24 | 0.15 | 0.23 |
| Dependability 50% | $Mm^3/yr$ | 0.28 | 0.17 | 0.25 | 0.16 | 0.24 | 0.15 | 0.23 |
| Dependability 25% | $Mm^3/yr$ | 0.28 | 0.17 | 0.25 | 0.16 | 0.24 | 0.15 | 0.23 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 5.07 | 3.03 | 5.01 | 2.99 | 4.94 | 2.95 | 4.87 |
| Dependability 90% | $Mm^3/yr$ | 1.57 | 0.94 | 1.54 | 0.93 | 1.53 | 0.93 | 1.52 |
| Dependability 75% | $Mm^3/yr$ | 4.33 | 2.60 | 4.30 | 2.59 | 4.29 | 2.59 | 4.28 |
| Dependability 50% | $Mm^3/yr$ | 6.11 | 3.65 | 6.03 | 3.58 | 5.93 | 3.52 | 5.83 |
| Dependability 25% | $Mm^3/yr$ | 6.11 | 3.65 | 6.03 | 3.58 | 5.93 | 3.52 | 5.83 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 90% | $Mm^3/yr$ | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 25% | $Mm^3/yr$ | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 5.09 | 3.06 | 5.04 | 3.02 | 4.97 | 2.98 | 4.90 |
| Dependability 90% | $Mm^3/yr$ | 1.59 | 0.97 | 1.57 | 0.96 | 1.56 | 0.96 | 1.55 |
| Dependability 75% | $Mm^3/yr$ | 4.35 | 2.63 | 4.33 | 2.62 | 4.32 | 2.62 | 4.31 |
| Dependability 50% | $Mm^3/yr$ | 6.12 | 3.67 | 6.06 | 3.61 | 5.96 | 3.55 | 5.86 |
| Dependability 25% | $Mm^3/yr$ | 6.12 | 3.67 | 6.06 | 3.61 | 5.96 | 3.55 | 5.86 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 6.02 | 3.90 | 5.88 | 3.81 | 5.76 | 3.73 | 5.65 |
| Dependability 90% | $Mm^3/yr$ | 2.52 | 1.81 | 2.41 | 1.75 | 2.35 | 1.71 | 2.30 |
| Dependability 75% | $Mm^3/yr$ | 5.28 | 3.47 | 5.17 | 3.41 | 5.11 | 3.37 | 5.06 |
| Dependability 50% | $Mm^3/yr$ | 7.06 | 4.51 | 6.90 | 4.40 | 6.75 | 4.30 | 6.61 |
| Dependability 25% | $Mm^3/yr$ | 7.06 | 4.51 | 6.90 | 4.40 | 6.75 | 4.30 | 6.61 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 6.02 | 3.90 | 5.88 | 3.81 | 5.76 | 3.73 | 5.65 |
| Dependability 90% | $Mm^3/yr$ | 2.52 | 1.81 | 2.41 | 1.75 | 2.35 | 1.71 | 2.30 |
| Dependability 75% | $Mm^3/yr$ | 5.28 | 3.47 | 5.17 | 3.41 | 5.11 | 3.37 | 5.06 |
| Dependability 50% | $Mm^3/yr$ | 7.06 | 4.51 | 6.90 | 4.40 | 6.75 | 4.30 | 6.61 |
| Dependability 25% | $Mm^3/yr$ | 7.06 | 4.51 | 6.90 | 4.40 | 6.75 | 4.30 | 6.61 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 267 | 173 | 260 | 169 | 255 | 165 | 251 |
| | Dependability 90% | mm/yr | 112 | 80 | 107 | 78 | 104 | 76 | 102 |
| | Dependability 75% | mm/yr | 234 | 154 | 229 | 151 | 226 | 149 | 224 |
| | Dependability 50% | mm/yr | 313 | 200 | 306 | 195 | 299 | 191 | 293 |
| | Dependability 25% | mm/yr | 313 | 200 | 306 | 195 | 299 | 191 | 293 |
| Well Yield | | $10^3 m^3/yr$ | 24 | | | | | | |
| No. of Irrigation Wells | Existing | | 321 | 321 | 321 | 321 | 321 | 321 | 321 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 10.34 | 9.63 | 10.18 | 9.47 | 10.01 | 9.32 | 9.85 |
| | Dependability 90% | $Mm^3/yr$ | 3.68 | 3.36 | 3.57 | 3.31 | 3.51 | 3.26 | 3.46 |
| | Dependability 75% | $Mm^3/yr$ | 8.94 | 8.34 | 8.82 | 8.29 | 8.76 | 8.24 | 8.71 |
| | Dependability 50% | $Mm^3/yr$ | 12.31 | 11.47 | 12.12 | 11.25 | 11.89 | 11.05 | 11.67 |
| | Dependability 25% | $Mm^3/yr$ | 12.31 | 11.47 | 12.12 | 11.25 | 11.89 | 11.05 | 11.67 |
| Depth | ted Mean | mm/yr | 458 | 426 | 451 | 419 | 443 | 413 | 436 |
| | Dependability 90% | mm/yr | 163 | 149 | 158 | 146 | 156 | 144 | 153 |
| | Dependability 75% | mm/yr | 396 | 370 | 391 | 367 | 388 | 365 | 386 |
| | Dependability 50% | mm/yr | 546 | 508 | 537 | 498 | 527 | 489 | 517 |
| | Dependability 25% | mm/yr | 546 | 508 | 537 | 498 | 527 | 489 | 517 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 12163 | | | | | | |
| | Total | Mill.Rs. | | 27.45 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 27.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.53 | | | | | | |
| Average Annual Cost | Mill.Rs | 3.19 | 2.07 | 3.12 | 2.02 | 3.05 | 1.98 | 3.00 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 3.19 | 2.07 | 3.12 | 2.02 | 3.05 | 1.98 | 3.00 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 3.19 | 2.07 | 3.12 | 2.02 | 3.05 | 1.98 | 3.00 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.150 | 0.200 | 0.342 | 0.308 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Galwania Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | CHAMBAL |
| Irrigation Demand Zone (IDZ) | Tonk,Bundi,Sawaimadhopur |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.15 | 0.2 | 0.342 | 0.308 |

| . | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| . | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 2257 | 2257 | 2257 | 2257 | 2257 | 2257 | 2257 |
| SW On-Farm Irrigation Efficiency | % | 26.85 | 70.00 | 26.85 | 70.00 | 26.85 | 70.00 | 26.85 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 1.16 | 1.55 | 1.16 | 1.55 | 1.16 | 1.55 | 1.16 |
| Dependability 75% | $Mm^3/yr$ | 3.66 | 4.87 | 3.66 | 4.87 | 3.66 | 4.87 | 3.66 |
| Dependability 50% | $Mm^3/yr$ | 5.26 | 6.96 | 5.22 | 6.85 | 5.14 | 6.74 | 5.06 |
| Dependability 25% | $Mm^3/yr$ | 5.26 | 6.96 | 5.22 | 6.85 | 5.14 | 6.74 | 5.06 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.52 | 1.81 | 2.41 | 1.75 | 2.35 | 1.71 | 2.30 |
| Dependability 75% | $Mm^3/yr$ | 5.28 | 3.47 | 5.17 | 3.41 | 5.11 | 3.37 | 5.06 |
| Dependability 50% | $Mm^3/yr$ | 7.06 | 4.51 | 6.90 | 4.40 | 6.75 | 4.30 | 6.61 |
| Dependability 25% | $Mm^3/yr$ | 7.06 | 4.51 | 6.90 | 4.40 | 6.75 | 4.30 | 6.61 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.52 | 1.81 | 2.41 | 1.75 | 2.35 | 1.71 | 2.30 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 | 1.54 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 41.27 | 53.94 | 39.20 | 60.72 | 43.51 | 67.31 | 48.17 |
| CMLP Irrig. Intensity Dependability 90% | % | 28.59 | 35.79 | 27.50 | 33.11 | 25.34 | 32.65 | 24.90 |
| Dependability 75% | % | 64.89 | 88.39 | 63.80 | 82.58 | 59.47 | 82.12 | 59.04 |
| Dependability 50% | % | 88.68 | 120.39 | 87.00 | 112.56 | 80.18 | 110.50 | 78.64 |
| Dependability 25% | % | 89.11 | 120.74 | 87.42 | 113.01 | 80.49 | 110.94 | 78.95 |
| Weighted Mean | % | 75.04 | 101.41 | 73.57 | 94.78 | 67.91 | 93.28 | 66.75 |
| CMLP GW Use Dependability 90% | % | 68.41 | 53.82 | 67.40 | 53.04 | 66.84 | 52.40 | 66.38 |
| Dependability 75% | % | 58.72 | 40.49 | 57.82 | 40.16 | 57.92 | 39.84 | 57.68 |
| Dependability 50% | % | 56.14 | 35.62 | 54.76 | 36.06 | 54.73 | 35.19 | 55.54 |
| Dependability 25% | % | 55.90 | 34.68 | 54.31 | 34.59 | 55.44 | 35.25 | 54.20 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.03 | 0.00 | 3.03 | 0.00 | 3.03 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 3.19 | 5.09 | 3.12 | 5.05 | 3.05 | 5.00 | 3.00 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.03 | 0.00 | 3.03 | 0.00 | 3.03 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 3.19 | 5.09 | 3.12 | 5.05 | 3.05 | 5.00 | 3.00 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 41.27 | 53.94 | 39.20 | 60.72 | 43.51 | 67.31 | 48.17 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 5.07 | 6.93 | 4.97 | 6.82 | 4.88 | 6.71 | 4.80 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 10.34 | 9.63 | 10.18 | 9.47 | 10.01 | 9.32 | 9.85 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 59.19 | 62.57 | -3.38 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 59.19 | 62.57 | -3.38 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 344.24 | 249.26 | 94.98 |
| 5. Total Project Costs | Mill.Rs. | | 31.39 | 19.14 | 12.25 |
| 6. Project Capital Costs | Mill.Rs. | | 18.71 | 0.00 | 18.71 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 31.39 | 19.14 | 12.25 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 18.71 | 0.00 | 18.71 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 312.85 | 230.12 | 82.73 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.53 | 0.31 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 8289 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 3.64 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **5.42** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Gopalpura Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Chambal | Linked to Project(s): | |
| District | Baran | Name(s): | |
| Groundwater Potential Zone (PZ) | Baran,Kishanganj | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 229.22 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 31.16841 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.13 | 0.26 | 0.26 | 0.31 | 0.31 | 0.34 | 0.34 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.11 | 0.12 | 0.12 | 0.13 | 0.13 | 0.14 | 0.14 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,557 | 3,557 | 3,557 | 3,557 | 3,557 | 3,557 | 3,557 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 21.99 | | | | | | |
| 2010 Irrigated Area | | ha | 4000 | | | | | | |

### III. Water Sources

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 51.42 | 51.42 | 51.42 | 51.42 | 51.42 | 51.42 | 51.42 |
| | Dependability 90% | $Mm^3/yr$ | 16.78 | 16.78 | 16.78 | 16.78 | 16.78 | 16.78 | 16.78 |
| | Dependability 75% | $Mm^3/yr$ | 22.04 | 22.04 | 22.04 | 22.04 | 22.04 | 22.04 | 22.04 |
| | Dependability 50% | $Mm^3/yr$ | 44.09 | 44.09 | 44.09 | 44.09 | 44.09 | 44.09 | 44.09 |
| | Dependability 25% | $Mm^3/yr$ | 67.36 | 67.36 | 67.36 | 67.36 | 67.36 | 67.36 | 67.36 |
| | Weighted Mean | $Mm^3/yr$ | 43.58 | 43.58 | 43.58 | 43.58 | 43.58 | 43.58 | 43.58 |
| Losses from Reservoir | Annual | % | 16.21 | | | | | | |
| | During the Rabi Season | % | 7.42 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 214.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.05 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.49 | 0.49 | 1.47 | 1.47 | 2.45 | 2.45 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 31.17 | 30.68 | 30.68 | 29.70 | 29.70 | 28.72 | 28.72 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 24.94 | 24.65 | 24.65 | 24.06 | 24.06 | 23.48 | 23.48 |
| Dependability 90% | $Mm^3/yr$ | 15.53 | 15.53 | 15.53 | 15.53 | 15.53 | 15.53 | 15.53 |
| Dependability 75% | $Mm^3/yr$ | 20.40 | 20.40 | 20.40 | 20.40 | 20.40 | 20.40 | 20.40 |
| Dependability 50% | $Mm^3/yr$ | 28.86 | 28.40 | 28.40 | 27.49 | 27.49 | 26.59 | 26.59 |
| Dependability 25% | $Mm^3/yr$ | 28.86 | 28.40 | 28.40 | 27.49 | 27.49 | 26.59 | 26.59 |
| On-Farm Irrigation Efficiency | % | 61.01 | 70.00 | 61.01 | 70.00 | 61.01 | 70.00 | 61.01 |
| Off-Farm Irrigation Efficiency | % | 90.27 | 90.27 | 90.27 | 90.27 | 90.27 | 90.27 | 90.27 |
| Present Overall Irrigation Efficiency | % | 55.07 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 22.51 | 22.25 | 22.25 | 21.72 | 21.72 | 21.20 | 21.20 |
| Dependability 90% | $Mm^3/yr$ | 14.02 | 14.02 | 14.02 | 14.02 | 14.02 | 14.02 | 14.02 |
| Dependability 75% | $Mm^3/yr$ | 18.42 | 18.42 | 18.42 | 18.42 | 18.42 | 18.42 | 18.42 |
| Dependability 50% | $Mm^3/yr$ | 26.05 | 25.64 | 25.64 | 24.82 | 24.82 | 24.00 | 24.00 |
| Dependability 25% | $Mm^3/yr$ | 26.05 | 25.64 | 25.64 | 24.82 | 24.82 | 24.00 | 24.00 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 633 | 625 | 625 | 611 | 611 | 596 | 596 |
| Dependability 90% | mm/yr | 394 | 394 | 394 | 394 | 394 | 394 | 394 |
| Dependability 75% | mm/yr | 518 | 518 | 518 | 518 | 518 | 518 | 518 |
| Dependability 50% | mm/yr | 732 | 721 | 721 | 698 | 698 | 675 | 675 |
| Dependability 25% | mm/yr | 732 | 721 | 721 | 698 | 698 | 675 | 675 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 7.21 | 7.10 | 7.10 | 6.87 | 6.87 | 6.65 | 6.65 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 16.65 | 16.96 | 16.96 | 17.59 | 17.59 | 18.22 | 18.22 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 12.92 | 13.41 | 13.41 | 14.39 | 14.39 | 15.37 | 15.37 |
| Dependability 25% | $Mm^3/yr$ | 36.19 | 36.68 | 36.68 | 37.66 | 37.66 | 38.64 | 38.64 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 31.45 | | 31.45 | | 31.45 | | 31.45 |
| Weighted Mean | $Mm^3/yr$ | 7.84 | 10.00 | 7.75 | 9.76 | 7.57 | 9.53 | 7.39 |
| Dependability 90% | $Mm^3/yr$ | 4.89 | 6.30 | 4.89 | 6.30 | 4.89 | 6.30 | 4.89 |
| Dependability 75% | $Mm^3/yr$ | 6.42 | 8.28 | 6.42 | 8.28 | 6.42 | 8.28 | 6.42 |
| Dependability 50% | $Mm^3/yr$ | 9.08 | 11.52 | 8.93 | 11.15 | 8.65 | 10.78 | 8.36 |
| Dependability 25% | $Mm^3/yr$ | 9.08 | 11.52 | 8.93 | 11.15 | 8.65 | 10.78 | 8.36 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.65 | 0.40 | 0.60 | 0.39 | 0.59 | 0.38 | 0.57 |
| Dependability 90% | $Mm^3/yr$ | 0.65 | 0.40 | 0.60 | 0.39 | 0.59 | 0.38 | 0.57 |
| Dependability 75% | $Mm^3/yr$ | 0.65 | 0.40 | 0.60 | 0.39 | 0.59 | 0.38 | 0.57 |
| Dependability 50% | $Mm^3/yr$ | 0.65 | 0.40 | 0.60 | 0.39 | 0.59 | 0.38 | 0.57 |
| Dependability 25% | $Mm^3/yr$ | 0.65 | 0.40 | 0.60 | 0.39 | 0.59 | 0.38 | 0.57 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 8.49 | 10.40 | 8.35 | 10.15 | 8.15 | 9.91 | 7.96 |
| Dependability 90% | $Mm^3/yr$ | 5.53 | 6.70 | 5.49 | 6.69 | 5.47 | 6.68 | 5.46 |
| Dependability 75% | $Mm^3/yr$ | 7.06 | 8.68 | 7.02 | 8.67 | 7.00 | 8.66 | 6.99 |
| Dependability 50% | $Mm^3/yr$ | 9.72 | 11.92 | 9.54 | 11.54 | 9.23 | 11.17 | 8.93 |
| Dependability 25% | $Mm^3/yr$ | 9.72 | 11.92 | 9.54 | 11.54 | 9.23 | 11.17 | 8.93 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 90% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 50% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Dependability 25% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 8.51 | 10.43 | 8.39 | 10.19 | 8.19 | 9.95 | 8.00 |
| Dependability 90% | $Mm^3/yr$ | 5.55 | 6.74 | 5.52 | 6.73 | 5.51 | 6.73 | 5.50 |
| Dependability 75% | $Mm^3/yr$ | 7.08 | 8.71 | 7.06 | 8.71 | 7.04 | 8.70 | 7.03 |
| Dependability 50% | $Mm^3/yr$ | 9.74 | 11.96 | 9.57 | 11.58 | 9.27 | 11.21 | 8.98 |
| Dependability 25% | $Mm^3/yr$ | 9.74 | 11.96 | 9.57 | 11.58 | 9.27 | 11.21 | 8.98 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 10.66 | 12.44 | 10.40 | 12.14 | 10.14 | 11.86 | 9.91 |
| Dependability 90% | $Mm^3/yr$ | 7.71 | 8.75 | 7.53 | 8.68 | 7.46 | 8.64 | 7.41 |
| Dependability 75% | $Mm^3/yr$ | 9.24 | 10.72 | 9.07 | 10.66 | 8.99 | 10.61 | 8.94 |
| Dependability 50% | $Mm^3/yr$ | 11.89 | 13.97 | 11.58 | 13.53 | 11.22 | 13.12 | 10.89 |
| Dependability 25% | $Mm^3/yr$ | 11.89 | 13.97 | 11.58 | 13.53 | 11.22 | 13.12 | 10.89 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 10.66 | 12.44 | 10.40 | 12.14 | 10.14 | 11.86 | 9.91 |
| Dependability 90% | $Mm^3/yr$ | 7.71 | 8.75 | 7.53 | 8.68 | 7.46 | 8.64 | 7.41 |
| Dependability 75% | $Mm^3/yr$ | 9.24 | 10.72 | 9.07 | 10.66 | 8.99 | 10.61 | 8.94 |
| Dependability 50% | $Mm^3/yr$ | 11.89 | 13.97 | 11.58 | 13.53 | 11.22 | 13.12 | 10.89 |
| Dependability 25% | $Mm^3/yr$ | 11.89 | 13.97 | 11.58 | 13.53 | 11.22 | 13.12 | 10.89 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 300 | 350 | 292 | 341 | 285 | 333 | 279 |
| | Dependability 90% | mm/yr | 217 | 246 | 212 | 244 | 210 | 243 | 208 |
| | Dependability 75% | mm/yr | 260 | 301 | 255 | 300 | 253 | 298 | 251 |
| | Dependability 50% | mm/yr | 334 | 393 | 326 | 380 | 315 | 369 | 306 |
| | Dependability 25% | mm/yr | 334 | 393 | 326 | 380 | 315 | 369 | 306 |
| Well Yield | | $10^3 m^3/yr$ | 92 | | | | | | |
| No. of Irrigation Wells | Existing | | 378 | 378 | 378 | 378 | 378 | 378 | 378 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 34.80 | 34.80 | 34.80 | 34.80 | 34.80 | 34.80 | 34.80 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 6.96 | 6.96 | 6.96 | 6.96 | 6.96 | 6.96 | 6.96 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 33.17 | 34.69 | 32.65 | 33.87 | 31.87 | 33.06 | 31.11 |
| | Dependability 90% | $Mm^3/yr$ | 21.73 | 22.77 | 21.56 | 22.71 | 21.48 | 22.66 | 21.43 |
| | Dependability 75% | $Mm^3/yr$ | 27.66 | 29.14 | 27.48 | 29.08 | 27.41 | 29.03 | 27.36 |
| | Dependability 50% | $Mm^3/yr$ | 37.94 | 39.61 | 37.22 | 38.35 | 36.04 | 37.12 | 34.88 |
| | Dependability 25% | $Mm^3/yr$ | 37.94 | 39.61 | 37.22 | 38.35 | 36.04 | 37.12 | 34.88 |
| Depth | ted Mean | mm/yr | 933 | 975 | 918 | 952 | 896 | 929 | 875 |
| | Dependability 90% | mm/yr | 611 | 640 | 606 | 638 | 604 | 637 | 603 |
| | Dependability 75% | mm/yr | 778 | 819 | 773 | 817 | 771 | 816 | 769 |
| | Dependability 50% | mm/yr | 1067 | 1113 | 1046 | 1078 | 1013 | 1043 | 981 |
| | Dependability 25% | mm/yr | 1067 | 1113 | 1046 | 1078 | 1013 | 1043 | 981 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9760 | | | | | | |
| | Total | Mill.Rs. | | 34.72 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 34.72 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.47 | | | | | | |
| Average Annual Cost | Mill.Rs | 5.01 | 5.85 | 4.89 | 5.71 | 4.77 | 5.57 | 4.66 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 5.01 | 5.85 | 4.89 | 5.71 | 4.77 | 5.57 | 4.66 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 5.01 | 5.85 | 4.89 | 5.71 | 4.77 | 5.57 | 4.66 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.180 | 0.280 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Gopalpura Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Chambal |
| Irrigation Demand Zone (IDZ) | Baran |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.18 | 0.28 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3557 | 3557 | 3557 | 3557 | 3557 | 3557 | 3557 |
| SW On-Farm Irrigation Efficiency | % | 61.01 | 70.00 | 61.01 | 70.00 | 61.01 | 70.00 | 61.01 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 14.02 | 14.02 | 14.02 | 14.02 | 14.02 | 14.02 | 14.02 |
| Dependability 75% | $Mm^3/yr$ | 18.42 | 18.42 | 18.42 | 18.42 | 18.42 | 18.42 | 18.42 |
| Dependability 50% | $Mm^3/yr$ | 26.05 | 25.64 | 25.64 | 24.82 | 24.82 | 24.00 | 24.00 |
| Dependability 25% | $Mm^3/yr$ | 26.05 | 25.64 | 25.64 | 24.82 | 24.82 | 24.00 | 24.00 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 7.71 | 8.75 | 7.53 | 8.68 | 7.46 | 8.64 | 7.41 |
| Dependability 75% | $Mm^3/yr$ | 9.24 | 10.72 | 9.07 | 10.66 | 8.99 | 10.61 | 8.94 |
| Dependability 50% | $Mm^3/yr$ | 11.89 | 13.97 | 11.58 | 13.53 | 11.22 | 13.12 | 10.89 |
| Dependability 25% | $Mm^3/yr$ | 11.89 | 13.97 | 11.58 | 13.53 | 11.22 | 13.12 | 10.89 |
| Firm GW for Kharif | $Mm^3/yr$ | 7.71 | 8.75 | 7.53 | 8.68 | 7.46 | 8.64 | 7.41 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 34.80 | 34.80 | 34.80 | 34.80 | 34.80 | 34.80 | 34.80 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 6.96 | 6.96 | 6.96 | 6.96 | 6.96 | 6.96 | 6.96 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 95.62 | 102.19 | 102.19 | 113.29 | 113.29 | 120.08 | 120.08 |
| CMLP Irrig. Intensity Dependability 90% | % | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 |
| Dependability 75% | % | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 |
| Dependability 50% | % | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 |
| Dependability 25% | % | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 |
| Weighted Mean | % | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 | 125.00 |
| CMLP GW Use Dependability 90% | % | 36.22 | 47.67 | 35.39 | 47.29 | 35.05 | 47.03 | 34.80 |
| Dependability 75% | % | 42.78 | 58.14 | 41.92 | 58.02 | 41.56 | 57.75 | 41.31 |
| Dependability 50% | % | 54.91 | 77.73 | 53.23 | 74.96 | 51.32 | 72.33 | 49.53 |
| Dependability 25% | % | 54.83 | 77.97 | 53.12 | 74.09 | 51.19 | 71.42 | 49.37 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.83 | 0.00 | 3.83 | 0.00 | 3.83 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 5.01 | 9.68 | 4.89 | 9.54 | 4.77 | 9.40 | 4.66 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.83 | 0.00 | 3.83 | 0.00 | 3.83 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 5.01 | 9.68 | 4.89 | 9.54 | 4.77 | 9.40 | 4.66 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 95.62 | 102.19 | 102.19 | 113.29 | 113.29 | 120.08 | 120.08 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 20.66 | 24.91 | 20.33 | 24.31 | 19.85 | 23.73 | 19.37 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 33.17 | 34.69 | 32.65 | 33.87 | 31.87 | 33.06 | 31.11 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 212.92 | 200.36 | 12.56 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 212.92 | 200.36 | 12.56 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 648.56 | 648.56 | 0.00 |
| 5. Total Project Costs | Mill.Rs. | | 59.55 | 29.99 | 29.56 |
| 6. Project Capital Costs | Mill.Rs. | | 23.66 | 0.00 | 23.66 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 59.55 | 29.99 | 29.56 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 23.66 | 0.00 | 23.66 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 589.01 | 618.57 | -29.56 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.28 | 0.15 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6652 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.50 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **-0.25** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Jaisamand Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | MAHI | Linked to Project(s): | |
| District | UDAIPUR | Name(s): | |
| Groundwater Potential Zone (PZ) | SALUMBER,SARADA | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 1654 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 206.95 | Code: | |
| Present Dead Storage, $Mm^3$ | 45.56 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 1.56 | 3.28 | 3.28 | 4.23 | 4.23 | 4.79 | 4.79 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 1.18 | 1.24 | 1.24 | 1.35 | 1.35 | 1.47 | 1.47 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 60.20 | | | | | | |
| 2010 Irrigated Area | | ha | 2899 | | | | | | |

### III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 176.11 | 176.11 | 176.11 | 176.11 | 176.11 | 176.11 | 176.11 |
| Dependability 90% | $Mm^3/yr$ | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Dependability 75% | $Mm^3/yr$ | 18.70 | 18.70 | 18.70 | 18.70 | 18.70 | 18.70 | 18.70 |
| Dependability 50% | $Mm^3/yr$ | 110.00 | 110.00 | 110.00 | 110.00 | 110.00 | 110.00 | 110.00 |
| Dependability 25% | $Mm^3/yr$ | 245.70 | 245.70 | 245.70 | 245.70 | 245.70 | 245.70 | 245.70 |
| Weighted Mean | $Mm^3/yr$ | 130.71 | 130.71 | 130.71 | 130.71 | 130.71 | 130.71 | 130.71 |
| Losses from Reservoir Annual | % | 13.10 | | | | | | |
| During the Rabi Season | % | 6.30 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 350.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.58 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 5.79 | 5.79 | 17.37 | 17.37 | 28.95 | 28.95 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 206.95 | 203.77 | 203.77 | 197.40 | 197.40 | 191.03 | 191.03 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 90.92 | 89.70 | 89.70 | 87.25 | 87.25 | 84.80 | 84.80 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 83.87 | 83.87 | 83.87 | 83.87 | 83.87 | 83.87 | 83.87 |
| Dependability 25% | $Mm^3/yr$ | 174.71 | 171.73 | 171.73 | 165.76 | 165.76 | 159.79 | 159.79 |
| On-Farm Irrigation Efficiency | % | 64.38 | 70.00 | 64.38 | 70.00 | 64.38 | 70.00 | 64.38 |
| Off-Farm Irrigation Efficiency | % | 52.00 | 72.00 | 52.00 | 72.00 | 52.00 | 72.00 | 52.00 |
| Present Overall Irrigation Efficiency | % | 33.48 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 47.28 | 64.58 | 46.64 | 62.82 | 45.37 | 61.06 | 44.10 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 43.61 | 60.38 | 43.61 | 60.38 | 43.61 | 60.38 | 43.61 |
| Dependability 25% | $Mm^3/yr$ | 90.85 | 123.64 | 89.30 | 119.35 | 86.19 | 115.05 | 83.09 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 295 | 404 | 292 | 393 | 284 | 382 | 276 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 50% | mm/yr | 273 | 377 | 273 | 377 | 273 | 377 | 273 |
| Dependability 25% | mm/yr | 568 | 773 | 558 | 746 | 539 | 719 | 519 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 43.68 | 42.93 | 42.93 | 41.44 | 41.44 | 39.95 | 39.95 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 15.89 | 17.19 | 17.19 | 19.80 | 19.80 | 22.41 | 22.41 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 38.75 | 41.93 | 41.93 | 48.30 | 48.30 | 54.67 | 54.67 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 15.46 | 15.46 | 15.46 | 15.46 | 15.46 | 15.46 | 15.46 |
| Dependability 90% | $Mm^3/yr$ | 4.35 | 4.35 | 4.35 | 4.35 | 4.35 | 4.35 | 4.35 |
| Dependability 75% | $Mm^3/yr$ | 16.25 | 16.25 | 16.25 | 16.25 | 16.25 | 16.25 | 16.25 |
| Dependability 50% | $Mm^3/yr$ | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 |
| Dependability 25% | $Mm^3/yr$ | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 | 17.81 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 9.87 | 9.87 | 9.87 | 9.87 | 9.87 | 9.87 | 9.87 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 46.56 | | 46.56 | | 46.56 | | 46.56 |
| Weighted Mean | $Mm^3/yr$ | 42.34 | 32.29 | 41.77 | 31.41 | 40.63 | 30.53 | 39.49 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 39.05 | 30.19 | 39.05 | 30.19 | 39.05 | 30.19 | 39.05 |
| Dependability 25% | $Mm^3/yr$ | 81.35 | 61.82 | 79.96 | 59.67 | 77.18 | 57.53 | 74.41 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 2.14 | 1.07 | 1.61 | 0.86 | 1.29 | 0.72 | 1.08 |
| Dependability 90% | $Mm^3/yr$ | 2.14 | 1.07 | 1.61 | 0.86 | 1.29 | 0.72 | 1.08 |
| Dependability 75% | $Mm^3/yr$ | 2.14 | 1.07 | 1.61 | 0.86 | 1.29 | 0.72 | 1.08 |
| Dependability 50% | $Mm^3/yr$ | 2.14 | 1.07 | 1.61 | 0.86 | 1.29 | 0.72 | 1.08 |
| Dependability 25% | $Mm^3/yr$ | 2.14 | 1.07 | 1.61 | 0.86 | 1.29 | 0.72 | 1.08 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 44.47 | 33.36 | 43.37 | 32.27 | 41.91 | 31.25 | 40.57 |
| Dependability 90% | $Mm^3/yr$ | 2.14 | 1.07 | 1.61 | 0.86 | 1.29 | 0.72 | 1.08 |
| Dependability 75% | $Mm^3/yr$ | 2.14 | 1.07 | 1.61 | 0.86 | 1.29 | 0.72 | 1.08 |
| Dependability 50% | $Mm^3/yr$ | 41.19 | 31.26 | 40.66 | 31.05 | 40.34 | 30.91 | 40.13 |
| Dependability 25% | $Mm^3/yr$ | 83.49 | 62.89 | 81.57 | 60.53 | 78.47 | 58.25 | 75.49 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 3.82 | 3.79 | 3.79 | 3.50 | 3.50 | 3.15 | 3.15 |
| Dependability 90% | $Mm^3/yr$ | 1.25 | 1.36 | 1.36 | 1.35 | 1.35 | 1.29 | 1.29 |
| Dependability 75% | $Mm^3/yr$ | 4.00 | 3.97 | 3.97 | 3.65 | 3.65 | 3.28 | 3.28 |
| Dependability 50% | $Mm^3/yr$ | 4.36 | 4.31 | 4.31 | 3.95 | 3.95 | 3.54 | 3.54 |
| Dependability 25% | $Mm^3/yr$ | 4.36 | 4.31 | 4.31 | 3.95 | 3.95 | 3.54 | 3.54 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 48.29 | 37.15 | 47.16 | 35.77 | 45.41 | 34.40 | 43.72 |
| Dependability 90% | $Mm^3/yr$ | 3.39 | 2.43 | 2.97 | 2.21 | 2.64 | 2.02 | 2.38 |
| Dependability 75% | $Mm^3/yr$ | 6.14 | 5.04 | 5.57 | 4.51 | 4.94 | 4.00 | 4.36 |
| Dependability 50% | $Mm^3/yr$ | 45.55 | 35.57 | 44.96 | 35.00 | 44.29 | 34.45 | 43.67 |
| Dependability 25% | $Mm^3/yr$ | 87.85 | 67.20 | 85.87 | 64.49 | 82.43 | 61.78 | 79.03 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 55.42 | 42.50 | 52.51 | 40.06 | 49.70 | 38.01 | 47.33 |
| Dependability 90% | $Mm^3/yr$ | 10.52 | 7.78 | 8.32 | 6.50 | 6.93 | 5.63 | 5.99 |
| Dependability 75% | $Mm^3/yr$ | 13.27 | 10.39 | 10.92 | 8.80 | 9.23 | 7.61 | 7.97 |
| Dependability 50% | $Mm^3/yr$ | 52.68 | 40.92 | 50.31 | 39.29 | 48.58 | 38.06 | 47.28 |
| Dependability 25% | $Mm^3/yr$ | 94.98 | 72.55 | 91.22 | 68.78 | 86.72 | 65.39 | 82.64 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 35.78 | 35.41 | 43.10 | 34.52 | 42.14 | 33.85 | 41.44 |
| Dependability 90% | $Mm^3/yr$ | 10.52 | 7.78 | 8.32 | 6.50 | 6.93 | 5.63 | 5.99 |
| Dependability 75% | $Mm^3/yr$ | 13.27 | 10.39 | 10.92 | 8.80 | 9.23 | 7.61 | 7.97 |
| Dependability 50% | $Mm^3/yr$ | 49.09 | 40.92 | 50.31 | 39.29 | 48.58 | 38.06 | 47.28 |
| Dependability 25% | $Mm^3/yr$ | 49.09 | 55.26 | 68.27 | 55.26 | 68.27 | 55.26 | 68.27 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 224 | 221 | 269 | 216 | 263 | 212 | 259 |
| | Dependability 90% | mm/yr | 66 | 49 | 52 | 41 | 43 | 35 | 37 |
| | Dependability 75% | mm/yr | 83 | 65 | 68 | 55 | 58 | 48 | 50 |
| | Dependability 50% | mm/yr | 307 | 256 | 314 | 246 | 304 | 238 | 296 |
| | Dependability 25% | mm/yr | 307 | 345 | 427 | 345 | 427 | 345 | 427 |
| Well Yield | | $10^3 m^3/yr$ | 14 | | | | | | |
| No. of Irrigation Wells | Existing | | 3519 | 3519 | 3519 | 3961 | 4894 | 3961 | 4894 |
| | Additional | | | 442 | 1375 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 49.09 | 55.26 | 68.27 | 55.26 | 68.27 | 55.26 | 68.27 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 9.82 | 11.05 | 13.65 | 11.05 | 13.65 | 11.05 | 13.65 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 83.06 | 100.00 | 89.75 | 97.34 | 87.51 | 94.91 | 85.54 |
| | Dependability 90% | $Mm^3/yr$ | 10.52 | 7.78 | 8.32 | 6.50 | 6.93 | 5.63 | 5.99 |
| | Dependability 75% | $Mm^3/yr$ | 13.27 | 10.39 | 10.92 | 8.80 | 9.23 | 7.61 | 7.97 |
| | Dependability 50% | $Mm^3/yr$ | 92.70 | 101.30 | 93.92 | 99.68 | 92.19 | 98.45 | 90.89 |
| | Dependability 25% | $Mm^3/yr$ | 139.94 | 178.90 | 157.57 | 174.60 | 154.47 | 170.31 | 151.36 |
| Depth | ted Mean | mm/yr | 519 | 625 | 561 | 608 | 547 | 593 | 535 |
| | Dependability 90% | mm/yr | 66 | 49 | 52 | 41 | 43 | 35 | 37 |
| | Dependability 75% | mm/yr | 83 | 65 | 68 | 55 | 58 | 48 | 50 |
| | Dependability 50% | mm/yr | 579 | 633 | 587 | 623 | 576 | 615 | 568 |
| | Dependability 25% | mm/yr | 875 | 1118 | 985 | 1091 | 965 | 1064 | 946 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.69 | 2.78 | 2.78 | 5.03 | 5.03 | 8.91 | 8.91 |
| | Annual Irrigation Depth | mm | 4.28 | 17.39 | 17.39 | 31.42 | 31.42 | 55.66 | 55.66 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 14370 | | | | | | |
| | Total | Mill.Rs. | | 229.92 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | 70 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 30.94 | 96.24 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | 18 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 7.96 | 24.75 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 268.81 | 120.99 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.31 | 0.96 | 0.31 | 0.96 | 0.31 | 0.96 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.40 | 1.24 | 0.40 | 1.24 | 0.40 | 1.24 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.45 | | | | | | |
| Average Annual Cost | Mill.Rs | 16.10 | 15.94 | 19.40 | 15.53 | 18.96 | 15.23 | 18.65 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 16.10 | 15.94 | 19.40 | 15.53 | 18.96 | 15.23 | 18.65 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 16.10 | 16.64 | 21.60 | 16.24 | 21.16 | 15.94 | 20.85 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.150 | 0.210 | 0.230 | 0.410 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Jaisamand Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | MAHI |
| Irrigation Demand Zone (IDZ) | UDAIPUR |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.15 | 0.21 | 0.23 | 0.41 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 |
| SW On-Farm Irrigation Efficiency | % | 64.38 | 70.00 | 64.38 | 70.00 | 64.38 | 70.00 | 64.38 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 43.61 | 60.38 | 43.61 | 60.38 | 43.61 | 60.38 | 43.61 |
| Dependability 25% | $Mm^3/yr$ | 90.85 | 123.64 | 89.30 | 119.35 | 86.19 | 115.05 | 83.09 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 10.52 | 7.78 | 8.32 | 6.50 | 6.93 | 5.63 | 5.99 |
| Dependability 75% | $Mm^3/yr$ | 13.27 | 10.39 | 10.92 | 8.80 | 9.23 | 7.61 | 7.97 |
| Dependability 50% | $Mm^3/yr$ | 52.68 | 40.92 | 50.31 | 39.29 | 48.58 | 38.06 | 47.28 |
| Dependability 25% | $Mm^3/yr$ | 94.98 | 72.55 | 91.22 | 68.78 | 86.72 | 65.39 | 82.64 |
| Firm GW for Kharif | $Mm^3/yr$ | 10.52 | 7.78 | 8.32 | 6.50 | 6.93 | 5.63 | 5.99 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 49.09 | 55.26 | 68.27 | 55.26 | 68.27 | 55.26 | 68.27 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 9.82 | 11.05 | 13.65 | 11.05 | 13.65 | 11.05 | 13.65 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 363.39 | 374.33 | 353.54 | 429.69 | 404.52 | 485.82 | 457.77 |
| CMLP Irrig. Intensity Dependability 90% | % | 15.37 | 13.12 | 12.15 | 10.52 | 9.72 | 8.85 | 8.17 |
| Dependability 75% | % | 19.43 | 17.55 | 15.99 | 14.28 | 12.98 | 12.00 | 10.90 |
| Dependability 50% | % | 135.75 | 162.70 | 137.54 | 155.85 | 129.61 | 151.28 | 124.31 |
| Dependability 25% | % | 165.74 | 173.91 | 173.91 | 173.91 | 173.91 | 173.91 | 173.91 |
| Weighted Mean | % | 105.56 | 114.38 | 108.12 | 111.73 | 105.30 | 109.95 | 103.41 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 50% | % | 48.14 | 34.29 | 48.84 | 33.38 | 48.07 | 32.62 | 48.79 |
| Dependability 25% | % | 35.25 | 42.90 | 50.62 | 44.78 | 50.63 | 44.78 | 50.62 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 29.75 | 13.63 | 29.75 | 13.63 | 29.75 | 13.63 |
| Annuity Total Project Cost | Mill.Rs./yr | 16.10 | 46.39 | 35.22 | 45.99 | 34.79 | 45.69 | 34.47 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 29.75 | 13.63 | 29.75 | 13.63 | 29.75 | 13.63 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 16.10 | 46.39 | 35.22 | 45.99 | 34.79 | 45.69 | 34.47 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 363.39 | 374.33 | 353.54 | 429.69 | 404.52 | 485.82 | 457.77 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 53.70 | 71.77 | 58.05 | 69.86 | 56.60 | 68.13 | 55.33 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 83.06 | 100.00 | 89.75 | 97.34 | 87.51 | 94.91 | 85.54 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 15.46 | 15.46 | 15.46 | 15.46 | 15.46 | 15.46 | 15.46 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 708.79 | 646.19 | 62.60 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 613.29 | 550.69 | 62.60 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 95.50 | 95.50 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 2403.05 | 2267.71 | 135.34 |
| 5. Total Project Costs | Mill.Rs. | | 285.90 | 216.87 | 69.03 |
| 6. Project Capital Costs | Mill.Rs. | | 183.75 | 84.17 | 99.58 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 285.90 | 216.87 | 69.03 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 183.75 | 84.17 | 99.58 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 2117.15 | 2050.84 | 66.30 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.40 | 0.34 | |
| 2. Priority Sectors Use | % | | 13.47 | 14.78 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 11484 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.23 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **1.36** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Jakham Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category B | B |
| Status: | Existing | Reference Document: | |
| River Basin: | MAHI | Linked to Project(s): | |
| District | PRATAPGARGH | Name(s): | |
| Groundwater Potential Zone (PZ) | DHARIAWAD,PRATAPGARH | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 1010 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 127.52 | Code: | |
| Present Dead Storage, $Mm^3$ | 6.01 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 2.290 | 2.290 | 2.290 | 2.290 | 2.290 | 2.290 | 2.290 |
| | From GW | $Mm^3/yr$ | 0.62 | 0.63 | 0.63 | 0.66 | 0.66 | 0.80 | 0.80 |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 1.33 | 2.81 | 2.81 | 3.67 | 3.67 | 4.17 | 4.17 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 2.16 | 2.24 | 2.24 | 2.41 | 2.41 | 2.59 | 2.59 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 28,319 | 28,319 | 28,319 | 28,319 | 28,319 | 28,319 | 28,319 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 74.00 | | | | | | |
| 2010 Irrigated Area | | ha | 16858 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 316.92 | 316.92 | 316.92 | 316.92 | 316.92 | 316.92 | 316.92 |
| | Dependability 90% | $Mm^3/yr$ | 40.80 | 40.80 | 40.80 | 40.80 | 40.80 | 40.80 | 40.80 |
| | Dependability 75% | $Mm^3/yr$ | 152.40 | 152.40 | 152.40 | 152.40 | 152.40 | 152.40 | 152.40 |
| | Dependability 50% | $Mm^3/yr$ | 303.80 | 303.80 | 303.80 | 303.80 | 303.80 | 303.80 | 303.80 |
| | Dependability 25% | $Mm^3/yr$ | 410.80 | 410.80 | 410.80 | 410.80 | 410.80 | 410.80 | 410.80 |
| | Weighted Mean | $Mm^3/yr$ | 266.84 | 266.84 | 266.84 | 266.84 | 266.84 | 266.84 | 266.84 |
| Losses from Reservoir | Annual | % | 5.20 | | | | | | |
| | During the Rabi Season | % | 2.46 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 350.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.35 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 3.54 | 3.54 | 10.61 | 10.61 | 17.68 | 17.68 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 127.52 | 125.58 | 125.58 | 121.69 | 121.69 | 115.86 | 115.86 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 106.80 | 105.25 | 105.25 | 102.14 | 102.14 | 97.47 | 97.47 |
| Dependability 90% | $Mm^3/yr$ | 37.44 | 37.44 | 37.44 | 37.44 | 37.44 | 37.44 | 37.44 |
| Dependability 75% | $Mm^3/yr$ | 122.03 | 120.13 | 120.13 | 116.34 | 116.34 | 110.65 | 110.65 |
| Dependability 50% | $Mm^3/yr$ | 122.03 | 120.13 | 120.13 | 116.34 | 116.34 | 110.65 | 110.65 |
| Dependability 25% | $Mm^3/yr$ | 122.03 | 120.13 | 120.13 | 116.34 | 116.34 | 110.65 | 110.65 |
| On-Farm Irrigation Efficiency | % | 73.01 | 73.00 | 73.01 | 73.00 | 73.01 | 73.00 | 73.01 |
| Off-Farm Irrigation Efficiency | % | 56.16 | 72.00 | 56.16 | 72.00 | 56.16 | 72.00 | 56.16 |
| Present Overall Irrigation Efficiency | % | 41.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 59.98 | 75.78 | 59.11 | 73.54 | 57.36 | 70.18 | 54.74 |
| Dependability 90% | $Mm^3/yr$ | 21.03 | 26.96 | 21.03 | 26.96 | 21.03 | 26.96 | 21.03 |
| Dependability 75% | $Mm^3/yr$ | 68.53 | 86.49 | 67.47 | 83.76 | 65.34 | 79.67 | 62.14 |
| Dependability 50% | $Mm^3/yr$ | 68.53 | 86.49 | 67.47 | 83.76 | 65.34 | 79.67 | 62.14 |
| Dependability 25% | $Mm^3/yr$ | 68.53 | 86.49 | 67.47 | 83.76 | 65.34 | 79.67 | 62.14 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 212 | 268 | 209 | 260 | 203 | 248 | 193 |
| Dependability 90% | mm/yr | 74 | 95 | 74 | 95 | 74 | 95 | 74 |
| Dependability 75% | mm/yr | 242 | 305 | 238 | 296 | 231 | 281 | 219 |
| Dependability 50% | mm/yr | 242 | 305 | 238 | 296 | 231 | 281 | 219 |
| Dependability 25% | mm/yr | 242 | 305 | 238 | 296 | 231 | 281 | 219 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 30.51 | 30.03 | 30.03 | 29.08 | 29.08 | 27.66 | 27.66 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 154.93 | 156.52 | 156.52 | 159.71 | 159.71 | 164.49 | 164.49 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 24.88 | 26.82 | 26.82 | 30.71 | 30.71 | 36.55 | 36.55 |
| Dependability 50% | $Mm^3/yr$ | 176.28 | 178.22 | 178.22 | 182.11 | 182.11 | 187.95 | 187.95 |
| Dependability 25% | $Mm^3/yr$ | 283.28 | 285.22 | 285.22 | 289.11 | 289.11 | 294.95 | 294.95 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 |
| Dependability 90% | $Mm^3/yr$ | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 |
| Dependability 75% | $Mm^3/yr$ | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 |
| Dependability 50% | $Mm^3/yr$ | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 |
| Dependability 25% | $Mm^3/yr$ | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 4.73 | 4.73 | 4.73 | 4.73 | 4.73 | 4.73 | 4.73 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 41.30 | | 41.30 | | 41.30 | | 41.30 |
| Weighted Mean | $Mm^3/yr$ | 44.11 | 37.89 | 43.47 | 36.77 | 42.18 | 35.09 | 40.26 |
| Dependability 90% | $Mm^3/yr$ | 15.46 | 13.48 | 15.46 | 13.48 | 15.46 | 13.48 | 15.46 |
| Dependability 75% | $Mm^3/yr$ | 50.40 | 43.25 | 49.61 | 41.88 | 48.05 | 39.83 | 45.70 |
| Dependability 50% | $Mm^3/yr$ | 50.40 | 43.25 | 49.61 | 41.88 | 48.05 | 39.83 | 45.70 |
| Dependability 25% | $Mm^3/yr$ | 50.40 | 43.25 | 49.61 | 41.88 | 48.05 | 39.83 | 45.70 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 44.30 | 37.89 | 43.47 | 36.77 | 42.18 | 35.09 | 40.26 |
| Dependability 90% | $Mm^3/yr$ | 15.65 | 13.48 | 15.46 | 13.48 | 15.46 | 13.48 | 15.46 |
| Dependability 75% | $Mm^3/yr$ | 50.58 | 43.25 | 49.61 | 41.88 | 48.05 | 39.83 | 45.70 |
| Dependability 50% | $Mm^3/yr$ | 50.58 | 43.25 | 49.61 | 41.88 | 48.05 | 39.83 | 45.70 |
| Dependability 25% | $Mm^3/yr$ | 50.58 | 43.25 | 49.61 | 41.88 | 48.05 | 39.83 | 45.70 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.99 | 1.10 | 1.10 | 1.12 | 1.12 | 1.13 | 1.13 |
| Dependability 90% | $Mm^3/yr$ | 0.99 | 1.10 | 1.10 | 1.12 | 1.12 | 1.13 | 1.13 |
| Dependability 75% | $Mm^3/yr$ | 0.99 | 1.10 | 1.10 | 1.12 | 1.12 | 1.13 | 1.13 |
| Dependability 50% | $Mm^3/yr$ | 0.99 | 1.10 | 1.10 | 1.12 | 1.12 | 1.13 | 1.13 |
| Dependability 25% | $Mm^3/yr$ | 0.99 | 1.10 | 1.10 | 1.12 | 1.12 | 1.13 | 1.13 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 45.28 | 38.99 | 44.56 | 37.89 | 43.31 | 36.22 | 41.39 |
| Dependability 90% | $Mm^3/yr$ | 16.64 | 14.58 | 16.56 | 14.60 | 16.59 | 14.61 | 16.59 |
| Dependability 75% | $Mm^3/yr$ | 51.57 | 44.34 | 50.71 | 43.01 | 49.17 | 40.96 | 46.83 |
| Dependability 50% | $Mm^3/yr$ | 51.57 | 44.34 | 50.71 | 43.01 | 49.17 | 40.96 | 46.83 |
| Dependability 25% | $Mm^3/yr$ | 51.57 | 44.34 | 50.71 | 43.01 | 49.17 | 40.96 | 46.83 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 45.90 | 38.04 | 43.61 | 35.88 | 41.30 | 33.39 | 38.56 |
| Dependability 90% | $Mm^3/yr$ | 17.26 | 13.63 | 15.61 | 12.59 | 14.58 | 11.78 | 13.76 |
| Dependability 75% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Dependability 50% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Dependability 25% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 45.90 | 38.04 | 43.61 | 35.88 | 41.30 | 33.39 | 38.56 |
| Dependability 90% | $Mm^3/yr$ | 17.26 | 13.63 | 15.61 | 12.59 | 14.58 | 11.78 | 13.76 |
| Dependability 75% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Dependability 50% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Dependability 25% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 162 | 134 | 154 | 127 | 146 | 118 | 136 |
| | Dependability 90% | mm/yr | 61 | 48 | 55 | 44 | 51 | 42 | 49 |
| | Dependability 75% | mm/yr | 184 | 153 | 176 | 145 | 167 | 135 | 155 |
| | Dependability 50% | mm/yr | 184 | 153 | 176 | 145 | 167 | 135 | 155 |
| | Dependability 25% | mm/yr | 184 | 153 | 176 | 145 | 167 | 135 | 155 |
| Well Yield | | $10^3 m^3/yr$ | 25 | | | | | | |
| No. of Irrigation Wells | Existing | | 2257 | 2257 | 2257 | 2257 | 2257 | 2257 | 2257 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 57.17 | 57.17 | 57.17 | 57.17 | 57.17 | 57.17 | 57.17 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 11.43 | 11.43 | 11.43 | 11.43 | 11.43 | 11.43 | 11.43 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 105.88 | 113.81 | 102.72 | 109.42 | 98.66 | 103.57 | 93.29 |
| | Dependability 90% | $Mm^3/yr$ | 38.28 | 40.58 | 36.64 | 39.55 | 35.60 | 38.74 | 34.79 |
| | Dependability 75% | $Mm^3/yr$ | 120.72 | 129.89 | 117.23 | 124.76 | 112.50 | 117.80 | 106.14 |
| | Dependability 50% | $Mm^3/yr$ | 120.72 | 129.89 | 117.23 | 124.76 | 112.50 | 117.80 | 106.14 |
| | Dependability 25% | $Mm^3/yr$ | 120.72 | 129.89 | 117.23 | 124.76 | 112.50 | 117.80 | 106.14 |
| Depth | ted Mean | mm/yr | 374 | 402 | 363 | 386 | 348 | 366 | 329 |
| | Dependability 90% | mm/yr | 135 | 143 | 129 | 140 | 126 | 137 | 123 |
| | Dependability 75% | mm/yr | 426 | 459 | 414 | 441 | 397 | 416 | 375 |
| | Dependability 50% | mm/yr | 426 | 459 | 414 | 441 | 397 | 416 | 375 |
| | Dependability 25% | mm/yr | 426 | 459 | 414 | 441 | 397 | 416 | 375 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.11 | 0.46 | 0.46 | 0.83 | 0.83 | 1.54 | 1.55 |
| | Annual Irrigation Depth | mm | 0.40 | 1.61 | 1.61 | 2.94 | 2.94 | 5.45 | 5.46 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 8000 | | | | | | |
| | Total | Mill.Rs. | | 226.55 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 226.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.44 | | | | | | |
| Average Annual Cost | Mill.Rs | 20.20 | 16.74 | 19.19 | 15.79 | 18.17 | 14.69 | 16.96 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 20.20 | 16.74 | 19.19 | 15.79 | 18.17 | 14.69 | 16.96 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 20.20 | 16.74 | 19.19 | 15.79 | 18.17 | 14.69 | 16.96 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.200 | 0.240 | 0.380 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Jakham Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | MAHI |
| Irrigation Demand Zone (IDZ) | PRATAPGARGH |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.2 | 0.24 | 0.38 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 28319 | 28319 | 28319 | 28319 | 28319 | 28319 | 28319 |
| SW On-Farm Irrigation Efficiency | % | 73.01 | 73.00 | 73.01 | 73.00 | 73.01 | 73.00 | 73.01 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 21.03 | 26.96 | 21.03 | 26.96 | 21.03 | 26.96 | 21.03 |
| Dependability 75% | $Mm^3/yr$ | 68.53 | 86.49 | 67.47 | 83.76 | 65.34 | 79.67 | 62.14 |
| Dependability 50% | $Mm^3/yr$ | 68.53 | 86.49 | 67.47 | 83.76 | 65.34 | 79.67 | 62.14 |
| Dependability 25% | $Mm^3/yr$ | 68.53 | 86.49 | 67.47 | 83.76 | 65.34 | 79.67 | 62.14 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 17.26 | 13.63 | 15.61 | 12.59 | 14.58 | 11.78 | 13.76 |
| Dependability 75% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Dependability 50% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Dependability 25% | $Mm^3/yr$ | 52.19 | 43.39 | 49.76 | 40.99 | 47.16 | 38.13 | 44.00 |
| Firm GW for Kharif | $Mm^3/yr$ | 17.26 | 13.63 | 15.61 | 12.59 | 14.58 | 11.78 | 13.76 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 57.17 | 57.17 | 57.17 | 57.17 | 57.17 | 57.17 | 57.17 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 11.43 | 11.43 | 11.43 | 11.43 | 11.43 | 11.43 | 11.43 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 607.51 | 672.54 | 573.56 | 774.22 | 660.15 | 848.61 | 723.44 |
| CMLP Irrig. Intensity Dependability 90% | % | 35.48 | 38.60 | 32.92 | 37.60 | 32.05 | 30.41 | 25.91 |
| Dependability 75% | % | 112.46 | 123.91 | 105.67 | 119.00 | 101.47 | 92.78 | 79.10 |
| Dependability 50% | % | 113.09 | 124.63 | 106.28 | 119.69 | 102.05 | 93.28 | 79.53 |
| Dependability 25% | % | 113.47 | 125.00 | 106.64 | 120.10 | 102.40 | 93.52 | 79.73 |
| Weighted Mean | % | 99.14 | 109.14 | 93.09 | 104.93 | 89.47 | 81.95 | 69.87 |
| CMLP GW Use Dependability 90% | % | 45.08 | 33.58 | 42.61 | 31.84 | 40.94 | 30.41 | 39.55 |
| Dependability 75% | % | 41.66 | 32.03 | 40.88 | 31.46 | 40.34 | 31.84 | 40.85 |
| Dependability 50% | % | 38.90 | 29.74 | 39.04 | 28.42 | 38.48 | 30.93 | 40.12 |
| Dependability 25% | % | 37.65 | 28.59 | 37.96 | 27.99 | 37.38 | 30.24 | 39.79 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 25.00 | 0.00 | 25.00 | 0.00 | 25.00 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 20.20 | 41.73 | 19.19 | 40.79 | 18.17 | 39.69 | 16.96 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 25.00 | 0.00 | 25.00 | 0.00 | 25.00 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 20.20 | 41.73 | 19.19 | 40.79 | 18.17 | 39.69 | 16.96 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 607.51 | 672.54 | 573.56 | 774.22 | 660.15 | 848.61 | 723.44 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 73.63 | 83.84 | 71.50 | 80.59 | 68.72 | 76.27 | 65.02 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 105.88 | 113.81 | 102.72 | 109.42 | 98.66 | 103.57 | 93.29 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 | 2.29 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 709.61 | 641.67 | 67.94 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 695.47 | 627.52 | 67.94 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 14.14 | 14.14 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 4315.68 | 3680.30 | 635.38 |
| 5. Total Project Costs | Mill.Rs. | | 256.18 | 116.82 | 139.36 |
| 6. Project Capital Costs | Mill.Rs. | | 154.40 | 0.00 | 154.40 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 256.18 | 116.82 | 139.36 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 154.40 | 0.00 | 154.40 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 4059.50 | 3563.48 | 496.01 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.36 | 0.18 | |
| 2. Priority Sectors Use | % | | 1.99 | 2.20 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 5452 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.94 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **4.21** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Kalisil Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Karauli | Name(s): | |
| Groundwater Potential Zone (PZ) | Sapotra | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 331.52 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 35.96 | Code: | |
| Present Dead Storage, $Mm^3$ | 3.39 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.11 | 0.24 | 0.24 | 0.31 | 0.31 | 0.35 | 0.35 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.10 | 0.11 | 0.11 | 0.13 | 0.13 | 0.15 | 0.15 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 26.16 | | | | | | |
| 2010 Irrigated Area | | ha | 3322 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 45.76 | 45.76 | 45.76 | 45.76 | 45.76 | 45.76 | 45.76 |
| | Dependability 90% | $Mm^3/yr$ | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| | Dependability 75% | $Mm^3/yr$ | 11.00 | 11.00 | 11.00 | 11.00 | 11.00 | 11.00 | 11.00 |
| | Dependability 50% | $Mm^3/yr$ | 33.68 | 33.68 | 33.68 | 33.68 | 33.68 | 33.68 | 33.68 |
| | Dependability 25% | $Mm^3/yr$ | 70.60 | 70.60 | 70.60 | 70.60 | 70.60 | 70.60 | 70.60 |
| | Weighted Mean | $Mm^3/yr$ | 35.83 | 35.83 | 35.83 | 35.83 | 35.83 | 35.83 | 35.83 |
| Losses from Reservoir | Annual | % | 9.73 | | | | | | |
| | During the Rabi Season | % | 4.68 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.04 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.43 | 0.43 | 1.30 | 1.30 | 2.17 | 2.17 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 35.96 | 35.72 | 35.72 | 35.24 | 35.24 | 34.77 | 34.77 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 23.25 | 23.18 | 23.18 | 23.03 | 23.03 | 22.88 | 22.88 |
| Dependability 90% | $Mm^3/yr$ | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 |
| Dependability 75% | $Mm^3/yr$ | 10.49 | 10.49 | 10.49 | 10.49 | 10.49 | 10.49 | 10.49 |
| Dependability 50% | $Mm^3/yr$ | 32.10 | 32.10 | 32.10 | 32.10 | 32.10 | 32.10 | 32.10 |
| Dependability 25% | $Mm^3/yr$ | 34.28 | 34.05 | 34.05 | 33.59 | 33.59 | 33.14 | 33.14 |
| On-Farm Irrigation Efficiency | % | 61.51 | 70.00 | 61.51 | 70.00 | 61.51 | 70.00 | 61.51 |
| Off-Farm Irrigation Efficiency | % | 36.45 | 72.00 | 36.45 | 72.00 | 36.45 | 72.00 | 36.45 |
| Present Overall Irrigation Efficiency | % | 22.42 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 8.48 | 16.69 | 8.45 | 16.58 | 8.39 | 16.47 | 8.34 |
| Dependability 90% | $Mm^3/yr$ | 0.21 | 0.41 | 0.21 | 0.41 | 0.21 | 0.41 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 3.82 | 7.55 | 3.82 | 7.55 | 3.82 | 7.55 | 3.82 |
| Dependability 50% | $Mm^3/yr$ | 11.70 | 23.11 | 11.70 | 23.11 | 11.70 | 23.11 | 11.70 |
| Dependability 25% | $Mm^3/yr$ | 12.49 | 24.52 | 12.41 | 24.19 | 12.25 | 23.86 | 12.08 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 180 | 355 | 180 | 353 | 179 | 350 | 177 |
| Dependability 90% | mm/yr | 4 | 9 | 4 | 9 | 4 | 9 | 4 |
| Dependability 75% | mm/yr | 81 | 161 | 81 | 161 | 81 | 161 | 81 |
| Dependability 50% | mm/yr | 249 | 492 | 249 | 492 | 249 | 492 | 249 |
| Dependability 25% | mm/yr | 266 | 522 | 264 | 515 | 261 | 508 | 257 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 8.57 | 8.51 | 8.51 | 8.40 | 8.40 | 8.28 | 8.28 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 11.43 | 11.51 | 11.51 | 11.67 | 11.67 | 11.83 | 11.83 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 34.64 | 34.88 | 34.88 | 35.36 | 35.36 | 35.83 | 35.83 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 3.28 | 3.28 | 3.28 | 3.28 | 3.28 | 3.28 | 3.28 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 54.31 | | 54.31 | | 54.31 | | 54.31 |
| Weighted Mean | $Mm^3/yr$ | 12.63 | 8.34 | 12.59 | 8.29 | 12.51 | 8.24 | 12.42 |
| Dependability 90% | $Mm^3/yr$ | 0.31 | 0.21 | 0.31 | 0.21 | 0.31 | 0.21 | 0.31 |
| Dependability 75% | $Mm^3/yr$ | 5.69 | 3.77 | 5.69 | 3.77 | 5.69 | 3.77 | 5.69 |
| Dependability 50% | $Mm^3/yr$ | 17.43 | 11.56 | 17.43 | 11.56 | 17.43 | 11.56 | 17.43 |
| Dependability 25% | $Mm^3/yr$ | 18.61 | 12.26 | 18.49 | 12.09 | 18.24 | 11.93 | 18.00 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.92 | 0.59 | 0.88 | 0.57 | 0.85 | 0.56 | 0.83 |
| Dependability 90% | $Mm^3/yr$ | 0.92 | 0.59 | 0.88 | 0.57 | 0.85 | 0.56 | 0.83 |
| Dependability 75% | $Mm^3/yr$ | 0.92 | 0.59 | 0.88 | 0.57 | 0.85 | 0.56 | 0.83 |
| Dependability 50% | $Mm^3/yr$ | 0.92 | 0.59 | 0.88 | 0.57 | 0.85 | 0.56 | 0.83 |
| Dependability 25% | $Mm^3/yr$ | 0.92 | 0.59 | 0.88 | 0.57 | 0.85 | 0.56 | 0.83 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 13.55 | 8.93 | 13.47 | 8.86 | 13.36 | 8.79 | 13.26 |
| Dependability 90% | $Mm^3/yr$ | 1.23 | 0.79 | 1.19 | 0.78 | 1.16 | 0.76 | 1.14 |
| Dependability 75% | $Mm^3/yr$ | 6.61 | 4.36 | 6.57 | 4.34 | 6.55 | 4.33 | 6.53 |
| Dependability 50% | $Mm^3/yr$ | 18.35 | 12.14 | 18.31 | 12.13 | 18.29 | 12.11 | 18.27 |
| Dependability 25% | $Mm^3/yr$ | 19.54 | 12.84 | 19.37 | 12.66 | 19.10 | 12.49 | 18.83 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 90% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 50% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 25% | $Mm^3/yr$ | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 13.57 | 8.96 | 13.50 | 8.90 | 13.40 | 8.84 | 13.30 |
| Dependability 90% | $Mm^3/yr$ | 1.25 | 0.82 | 1.22 | 0.81 | 1.20 | 0.81 | 1.19 |
| Dependability 75% | $Mm^3/yr$ | 6.63 | 4.39 | 6.60 | 4.38 | 6.59 | 4.38 | 6.57 |
| Dependability 50% | $Mm^3/yr$ | 18.37 | 12.17 | 18.34 | 12.17 | 18.33 | 12.16 | 18.31 |
| Dependability 25% | $Mm^3/yr$ | 19.55 | 12.88 | 19.40 | 12.70 | 19.14 | 12.53 | 18.88 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 16.64 | 11.89 | 16.42 | 11.74 | 16.25 | 11.62 | 16.09 |
| Dependability 90% | $Mm^3/yr$ | 4.32 | 3.75 | 4.15 | 3.66 | 4.05 | 3.59 | 3.97 |
| Dependability 75% | $Mm^3/yr$ | 9.70 | 7.32 | 9.53 | 7.23 | 9.43 | 7.16 | 9.36 |
| Dependability 50% | $Mm^3/yr$ | 21.44 | 15.10 | 21.27 | 15.01 | 21.17 | 14.94 | 21.10 |
| Dependability 25% | $Mm^3/yr$ | 22.62 | 15.80 | 22.33 | 15.55 | 21.98 | 15.31 | 21.66 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 16.64 | 11.89 | 16.42 | 11.74 | 16.25 | 11.62 | 16.09 |
| Dependability 90% | $Mm^3/yr$ | 4.32 | 3.75 | 4.15 | 3.66 | 4.05 | 3.59 | 3.97 |
| Dependability 75% | $Mm^3/yr$ | 9.70 | 7.32 | 9.53 | 7.23 | 9.43 | 7.16 | 9.36 |
| Dependability 50% | $Mm^3/yr$ | 21.44 | 15.10 | 21.27 | 15.01 | 21.17 | 14.94 | 21.10 |
| Dependability 25% | $Mm^3/yr$ | 22.62 | 15.80 | 22.33 | 15.55 | 21.98 | 15.31 | 21.66 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 354 | 253 | 349 | 250 | 346 | 247 | 342 |
| | Dependability 90% | mm/yr | 92 | 80 | 88 | 78 | 86 | 76 | 85 |
| | Dependability 75% | mm/yr | 206 | 156 | 203 | 154 | 201 | 152 | 199 |
| | Dependability 50% | mm/yr | 456 | 321 | 453 | 319 | 451 | 318 | 449 |
| | Dependability 25% | mm/yr | 481 | 336 | 475 | 331 | 468 | 326 | 461 |
| Well Yield | | $10^3 m^3/yr$ | 63 | | | | | | |
| No. of Irrigation Wells | Existing | | 425 | 425 | 425 | 425 | 425 | 425 | 425 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 26.85 | 26.85 | 26.85 | 26.85 | 26.85 | 26.85 | 26.85 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 25.11 | 28.58 | 24.87 | 28.33 | 24.64 | 28.09 | 24.42 |
| | Dependability 90% | $Mm^3/yr$ | 4.53 | 4.16 | 4.35 | 4.07 | 4.26 | 4.00 | 4.18 |
| | Dependability 75% | $Mm^3/yr$ | 13.52 | 14.87 | 13.35 | 14.78 | 13.26 | 14.71 | 13.18 |
| | Dependability 50% | $Mm^3/yr$ | 33.14 | 38.22 | 32.97 | 38.13 | 32.88 | 38.05 | 32.80 |
| | Dependability 25% | $Mm^3/yr$ | 35.12 | 40.32 | 34.74 | 39.74 | 34.23 | 39.17 | 33.74 |
| Depth | ted Mean | mm/yr | 534 | 608 | 529 | 603 | 524 | 598 | 520 |
| | Dependability 90% | mm/yr | 96 | 89 | 93 | 87 | 91 | 85 | 89 |
| | Dependability 75% | mm/yr | 288 | 316 | 284 | 314 | 282 | 313 | 280 |
| | Dependability 50% | mm/yr | 705 | 813 | 702 | 811 | 699 | 810 | 698 |
| | Dependability 25% | mm/yr | 747 | 858 | 739 | 845 | 728 | 833 | 718 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11285 | | | | | | |
| | Total | Mill.Rs. | | 53.04 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 53.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.57 | | | | | | |
| Average Annual Cost | Mill.Rs | 9.48 | 6.78 | 9.36 | 6.69 | 9.26 | 6.62 | 9.17 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 9.48 | 6.78 | 9.36 | 6.69 | 9.26 | 6.62 | 9.17 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 9.48 | 6.78 | 9.36 | 6.69 | 9.26 | 6.62 | 9.17 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.180 | 0.310 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Kalisil Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Karauli |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.18 | 0.31 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 4700 | 4700 | 4700 | 4700 | 4700 | 4700 | 4700 |
| SW On-Farm Irrigation Efficiency | % | 61.51 | 70.00 | 61.51 | 70.00 | 61.51 | 70.00 | 61.51 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.21 | 0.41 | 0.21 | 0.41 | 0.21 | 0.41 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 3.82 | 7.55 | 3.82 | 7.55 | 3.82 | 7.55 | 3.82 |
| Dependability 50% | $Mm^3/yr$ | 11.70 | 23.11 | 11.70 | 23.11 | 11.70 | 23.11 | 11.70 |
| Dependability 25% | $Mm^3/yr$ | 12.49 | 24.52 | 12.41 | 24.19 | 12.25 | 23.86 | 12.08 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 4.32 | 3.75 | 4.15 | 3.66 | 4.05 | 3.59 | 3.97 |
| Dependability 75% | $Mm^3/yr$ | 9.70 | 7.32 | 9.53 | 7.23 | 9.43 | 7.16 | 9.36 |
| Dependability 50% | $Mm^3/yr$ | 21.44 | 15.10 | 21.27 | 15.01 | 21.17 | 14.94 | 21.10 |
| Dependability 25% | $Mm^3/yr$ | 22.62 | 15.80 | 22.33 | 15.55 | 21.98 | 15.31 | 21.66 |
| Firm GW for Kharif | $Mm^3/yr$ | 4.32 | 3.75 | 4.15 | 3.66 | 4.05 | 3.59 | 3.97 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 26.85 | 26.85 | 26.85 | 26.85 | 26.85 | 26.85 | 26.85 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 | 5.37 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 149.13 | 158.66 | 152.82 | 168.46 | 162.49 | 179.56 | 173.43 |
| CMLP Irrig. Intensity Dependability 90% | % | 25.00 | 26.40 | 24.04 | 25.83 | 23.51 | 25.38 | 23.08 |
| Dependability 75% | % | 73.97 | 92.04 | 73.01 | 91.48 | 72.47 | 91.02 | 72.04 |
| Dependability 50% | % | 133.33 | 133.33 | 133.33 | 133.33 | 133.33 | 133.33 | 133.33 |
| Dependability 25% | % | 133.33 | 133.33 | 133.33 | 133.33 | 133.33 | 133.33 | 133.33 |
| Weighted Mean | % | 103.15 | 106.65 | 102.80 | 106.45 | 102.61 | 106.28 | 102.45 |
| CMLP GW Use Dependability 90% | % | 95.40 | 90.10 | 95.21 | 89.89 | 95.10 | 89.71 | 95.01 |
| Dependability 75% | % | 71.40 | 48.40 | 71.02 | 48.09 | 70.81 | 47.84 | 70.64 |
| Dependability 50% | % | 78.79 | 61.63 | 78.06 | 61.21 | 54.50 | 60.86 | 54.50 |
| Dependability 25% | % | 84.05 | 64.66 | 81.45 | 63.41 | 61.67 | 62.24 | 58.25 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.85 | 0.00 | 5.85 | 0.00 | 5.85 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 9.48 | 12.63 | 9.36 | 12.55 | 9.26 | 12.48 | 9.17 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.85 | 0.00 | 5.85 | 0.00 | 5.85 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 9.48 | 12.63 | 9.36 | 12.55 | 9.26 | 12.48 | 9.17 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 149.13 | 158.66 | 152.82 | 168.46 | 162.49 | 179.56 | 173.43 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 16.03 | 20.60 | 15.87 | 20.42 | 15.72 | 20.24 | 15.58 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 25.11 | 28.58 | 24.87 | 28.33 | 24.64 | 28.09 | 24.42 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 176.09 | 153.24 | 22.85 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 176.09 | 153.24 | 22.85 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 996.26 | 959.97 | 36.29 |
| 5. Total Project Costs | Mill.Rs. | | 77.87 | 57.65 | 20.21 |
| 6. Project Capital Costs | Mill.Rs. | | 36.15 | 0.00 | 36.15 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 77.87 | 57.65 | 20.21 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 36.15 | 0.00 | 36.15 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 918.39 | 902.32 | 16.08 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.44 | 0.38 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7691 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.21 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **1.44** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

# Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Khari Irrigation Project**

## I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Bhilwara | Name(s): | |
| Groundwater Potential Zone (PZ) | ASIND,HURDA | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 518 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 31.68 | Code: | |
| Present Dead Storage, $Mm^3$ | 3.68 | Name: | |

## II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | 0.91 | 1.06 | 1.06 | 1.82 | 1.82 | 2.11 | 2.11 |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.40 | 0.83 | 0.83 | 0.87 | 0.87 | 1.15 | 1.15 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.31 | 0.32 | 0.32 | 0.35 | 0.35 | 0.38 | 0.38 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 6,478 | 6,478 | 6,478 | 6,478 | 6,478 | 6,478 | 6,478 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 32.40 | | | | | | |
| 2010 Irrigated Area | | ha | 6 | | | | | | |

## III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 24.18 | 24.18 | 24.18 | 24.18 | 24.18 | 0.90 | 24.18 |
| Dependability 90% | $Mm^3/yr$ | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Dependability 75% | $Mm^3/yr$ | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 |
| Dependability 50% | $Mm^3/yr$ | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 |
| Dependability 25% | $Mm^3/yr$ | 37.80 | 37.80 | 37.80 | 37.80 | 37.80 | 37.80 | 37.80 |
| Weighted Mean | $Mm^3/yr$ | 17.51 | 17.51 | 17.51 | 17.51 | 17.51 | 17.51 | 17.51 |
| Losses from Reservoir Annual | % | 14.50 | | | | | | |
| During the Rabi Season | % | 7.28 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.07 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.68 | 0.68 | 2.04 | 2.04 | 3.39 | 3.39 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 31.68 | 31.31 | 31.31 | 30.56 | 30.56 | 29.81 | 29.81 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 14.19 | 14.07 | 14.07 | 13.82 | 13.82 | 13.57 | 13.57 |
| Dependability 90% | $Mm^3/yr$ | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 |
| Dependability 75% | $Mm^3/yr$ | 2.87 | 2.87 | 2.87 | 2.87 | 2.87 | 2.87 | 2.87 |
| Dependability 50% | $Mm^3/yr$ | 11.13 | 11.13 | 11.13 | 11.13 | 11.13 | 11.13 | 11.13 |
| Dependability 25% | $Mm^3/yr$ | 29.37 | 29.03 | 29.03 | 28.34 | 28.34 | 27.64 | 27.64 |
| On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| Off-Farm Irrigation Efficiency | % | 25.00 | 72.00 | 25.00 | 72.00 | 25.00 | 72.00 | 25.00 |
| Present Overall Irrigation Efficiency | % | 14.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 3.55 | 10.13 | 3.52 | 9.95 | 3.45 | 9.77 | 3.39 |
| Dependability 90% | $Mm^3/yr$ | 0.21 | 0.60 | 0.21 | 0.60 | 0.21 | 0.60 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 0.72 | 2.07 | 0.72 | 2.07 | 0.72 | 2.07 | 0.72 |
| Dependability 50% | $Mm^3/yr$ | 2.78 | 8.01 | 2.78 | 8.01 | 2.78 | 8.01 | 2.78 |
| Dependability 25% | $Mm^3/yr$ | 7.34 | 20.90 | 7.26 | 20.40 | 7.08 | 19.90 | 6.91 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 55 | 156 | 54 | 154 | 53 | 151 | 52 |
| Dependability 90% | mm/yr | 3 | 9 | 3 | 9 | 3 | 9 | 3 |
| Dependability 75% | mm/yr | 11 | 32 | 11 | 32 | 11 | 32 | 11 |
| Dependability 50% | mm/yr | 43 | 124 | 43 | 124 | 43 | 124 | 43 |
| Dependability 25% | mm/yr | 113 | 323 | 112 | 315 | 109 | 307 | 107 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 7.34 | 7.26 | 7.26 | 7.08 | 7.08 | 6.91 | 6.91 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 2.20 | 2.34 | 2.34 | 2.61 | 2.61 | 2.87 | 2.87 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 6.12 | 6.49 | 6.49 | 7.24 | 7.24 | 7.99 | 7.99 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.42 | 1.42 | 1.42 | 1.42 | 1.42 | 1.42 | 1.42 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 60.20 | | 60.20 | | 60.20 | | 60.20 |
| Weighted Mean | $Mm^3/yr$ | 8.54 | 5.06 | 8.47 | 4.97 | 8.32 | 4.89 | 8.17 |
| Dependability 90% | $Mm^3/yr$ | 0.50 | 0.30 | 0.50 | 0.30 | 0.50 | 0.30 | 0.50 |
| Dependability 75% | $Mm^3/yr$ | 1.73 | 1.03 | 1.73 | 1.03 | 1.73 | 1.03 | 1.73 |
| Dependability 50% | $Mm^3/yr$ | 6.70 | 4.01 | 6.70 | 4.01 | 6.70 | 4.01 | 6.70 |
| Dependability 25% | $Mm^3/yr$ | 17.68 | 10.45 | 17.47 | 10.20 | 17.06 | 9.95 | 16.64 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 8.54 | 5.06 | 8.47 | 4.97 | 8.32 | 4.89 | 8.17 |
| Dependability 90% | $Mm^3/yr$ | 0.50 | 0.30 | 0.50 | 0.30 | 0.50 | 0.30 | 0.50 |
| Dependability 75% | $Mm^3/yr$ | 1.73 | 1.03 | 1.73 | 1.03 | 1.73 | 1.03 | 1.73 |
| Dependability 50% | $Mm^3/yr$ | 6.70 | 4.01 | 6.70 | 4.01 | 6.70 | 4.01 | 6.70 |
| Dependability 25% | $Mm^3/yr$ | 17.68 | 10.45 | 17.47 | 10.20 | 17.06 | 9.95 | 16.64 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.28 | 0.34 | 0.34 | 0.46 | 0.46 | 0.49 | 0.49 |
| Dependability 90% | $Mm^3/yr$ | 0.28 | 0.34 | 0.34 | 0.46 | 0.46 | 0.49 | 0.49 |
| Dependability 75% | $Mm^3/yr$ | 0.28 | 0.34 | 0.34 | 0.46 | 0.46 | 0.49 | 0.49 |
| Dependability 50% | $Mm^3/yr$ | 0.28 | 0.34 | 0.34 | 0.46 | 0.46 | 0.49 | 0.49 |
| Dependability 25% | $Mm^3/yr$ | 0.28 | 0.34 | 0.34 | 0.46 | 0.46 | 0.49 | 0.49 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 8.82 | 5.40 | 8.81 | 5.44 | 8.78 | 5.38 | 8.66 |
| Dependability 90% | $Mm^3/yr$ | 0.78 | 0.64 | 0.84 | 0.76 | 0.97 | 0.79 | 0.99 |
| Dependability 75% | $Mm^3/yr$ | 2.01 | 1.37 | 2.07 | 1.50 | 2.19 | 1.53 | 2.22 |
| Dependability 50% | $Mm^3/yr$ | 6.97 | 4.34 | 7.03 | 4.47 | 7.16 | 4.50 | 7.19 |
| Dependability 25% | $Mm^3/yr$ | 17.96 | 10.79 | 17.81 | 10.66 | 17.52 | 10.44 | 17.13 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 8.62 | 4.64 | 8.02 | 4.00 | 7.28 | 3.55 | 6.66 |
| Dependability 90% | $Mm^3/yr$ | 0.57 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 1.80 | 0.58 | 1.28 | 0.00 | 0.57 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 6.77 | 3.55 | 6.24 | 2.85 | 5.54 | 2.28 | 4.97 |
| Dependability 25% | $Mm^3/yr$ | 17.75 | 10.00 | 17.02 | 9.05 | 15.90 | 8.22 | 14.91 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 8.62 | 4.64 | 8.02 | 4.00 | 7.28 | 3.55 | 6.66 |
| Dependability 90% | $Mm^3/yr$ | 0.57 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 1.80 | 0.58 | 1.28 | 0.00 | 0.57 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 6.77 | 3.55 | 6.24 | 2.85 | 5.54 | 2.28 | 4.97 |
| Dependability 25% | $Mm^3/yr$ | 17.75 | 10.00 | 17.02 | 9.05 | 15.90 | 8.22 | 14.91 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 133 | 72 | 124 | 62 | 112 | 55 | 103 |
| | Dependability 90% | mm/yr | 9 | 0 | 1 | 0 | 0 | 0 | 0 |
| | Dependability 75% | mm/yr | 28 | 9 | 20 | 0 | 9 | 0 | 0 |
| | Dependability 50% | mm/yr | 105 | 55 | 96 | 44 | 86 | 35 | 77 |
| | Dependability 25% | mm/yr | 274 | 154 | 263 | 140 | 245 | 127 | 230 |
| Well Yield | | $10^3 m^3/yr$ | 11 | | | | | | |
| No. of Irrigation Wells | Existing | | 1993 | 1993 | 1993 | 1993 | 1993 | 1993 | 1993 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 12.16 | 14.77 | 11.53 | 13.95 | 10.73 | 13.32 | 10.05 |
| | Dependability 90% | $Mm^3/yr$ | 0.78 | 0.60 | 0.26 | 0.60 | 0.21 | 0.60 | 0.21 |
| | Dependability 75% | $Mm^3/yr$ | 2.52 | 2.65 | 2.00 | 2.07 | 1.29 | 2.07 | 0.72 |
| | Dependability 50% | $Mm^3/yr$ | 9.55 | 11.56 | 9.03 | 10.86 | 8.32 | 10.29 | 7.75 |
| | Dependability 25% | $Mm^3/yr$ | 25.10 | 30.90 | 24.28 | 29.45 | 22.99 | 28.13 | 21.82 |
| Depth | ted Mean | mm/yr | 188 | 228 | 178 | 215 | 166 | 206 | 155 |
| | Dependability 90% | mm/yr | 12 | 9 | 4 | 9 | 3 | 9 | 3 |
| | Dependability 75% | mm/yr | 39 | 41 | 31 | 32 | 20 | 32 | 11 |
| | Dependability 50% | mm/yr | 147 | 178 | 139 | 168 | 128 | 159 | 120 |
| | Dependability 25% | mm/yr | 387 | 477 | 375 | 455 | 355 | 434 | 337 |
| **IV. Reclaimable Sewage** | | | | | | | | | |
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.04 | 0.17 | 0.17 | 0.51 | 0.51 | 1.06 | 1.06 |
| | Annual Irrigation Depth | mm | 0.54 | 2.56 | 2.56 | 7.91 | 7.93 | 16.29 | 16.29 |
| **V. Investments and Costs** (in 2010 terms) | | | | | | | | | |
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11138 | | | | | | |
| | Total | Mill.Rs. | | 72.15 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 72.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.51 | | | | | | |
| Average Annual Cost | Mill.Rs | 4.39 | 2.37 | 4.09 | 2.04 | 3.71 | 1.81 | 3.40 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 4.39 | 2.37 | 4.09 | 2.04 | 3.71 | 1.81 | 3.40 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 4.39 | 2.37 | 4.09 | 2.04 | 3.71 | 1.81 | 3.40 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.200 | 0.260 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Khari Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Bhilwara |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.2 | 0.26 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 6478 | 6478 | 6478 | 6478 | 6478 | 6478 | 6478 |
| SW On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.21 | 0.60 | 0.21 | 0.60 | 0.21 | 0.60 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 0.72 | 2.07 | 0.72 | 2.07 | 0.72 | 2.07 | 0.72 |
| Dependability 50% | $Mm^3/yr$ | 2.78 | 8.01 | 2.78 | 8.01 | 2.78 | 8.01 | 2.78 |
| Dependability 25% | $Mm^3/yr$ | 7.34 | 20.90 | 7.26 | 20.40 | 7.08 | 19.90 | 6.91 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.57 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 1.80 | 0.58 | 1.28 | 0.00 | 0.57 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 6.77 | 3.55 | 6.24 | 2.85 | 5.54 | 2.28 | 4.97 |
| Dependability 25% | $Mm^3/yr$ | 17.75 | 10.00 | 17.02 | 9.05 | 15.90 | 8.22 | 14.91 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.57 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 55.98 | 73.29 | 50.14 | 80.88 | 55.99 | 91.19 | 61.15 |
| CMLP Irrig. Intensity Dependability 90% | % | 1.96 | 0.00 | 0.64 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | % | 6.30 | 8.10 | 5.29 | 0.00 | 3.23 | 0.00 | 0.00 |
| Dependability 50% | % | 23.92 | 35.71 | 24.25 | 32.44 | 21.61 | 30.64 | 20.05 |
| Dependability 25% | % | 62.98 | 95.82 | 65.51 | 88.47 | 60.06 | 84.40 | 56.96 |
| Weighted Mean | % | 30.50 | 45.40 | 31.06 | 40.28 | 27.89 | 38.35 | 25.72 |
| CMLP GW Use Dependability 90% | % | 73.35 | 12.54 | 18.95 | 12.54 | 11.69 | 12.54 | 11.69 |
| Dependability 75% | % | 70.68 | 19.83 | 63.23 | 11.14 | 43.58 | 11.14 | 10.37 |
| Dependability 50% | % | 68.63 | 25.98 | 66.66 | 23.18 | 65.53 | 18.86 | 62.95 |
| Dependability 25% | % | 67.61 | 26.18 | 68.16 | 26.98 | 67.19 | 25.40 | 66.29 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 7.96 | 0.00 | 7.96 | 0.00 | 7.96 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 4.39 | 10.33 | 4.09 | 10.00 | 3.71 | 9.77 | 3.40 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 7.96 | 0.00 | 7.96 | 0.00 | 7.96 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 4.39 | 10.33 | 4.09 | 10.00 | 3.71 | 9.77 | 3.40 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 55.98 | 73.29 | 50.14 | 80.88 | 55.99 | 91.19 | 61.15 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 7.59 | 10.57 | 7.18 | 9.96 | 6.67 | 9.50 | 6.23 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 12.16 | 14.77 | 11.53 | 13.95 | 10.73 | 13.32 | 10.05 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 89.90 | 69.94 | 19.96 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 89.90 | 69.94 | 19.96 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 465.62 | 319.16 | 146.46 |
| 5. Total Project Costs | Mill.Rs. | | 63.26 | 24.64 | 38.62 |
| 6. Project Capital Costs | Mill.Rs. | | 49.17 | 0.00 | 49.17 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 63.26 | 24.64 | 38.62 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 49.17 | 0.00 | 49.17 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 402.35 | 294.52 | 107.84 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.70 | 0.35 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7591 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.70 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **3.19** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Kothari Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | BHILWARA | Name(s): | |
| Groundwater Potential Zone (PZ) | KOTRI,MANDALGARH | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 329 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 21.02 | Code: | |
| Present Dead Storage, $Mm^3$ | 4.12 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.20 | 0.40 | 0.40 | 0.50 | 0.50 | 0.55 | 0.55 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 1.560 | 1.560 | 1.560 | 1.560 | 1.560 | 1.560 | 1.560 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.09 | 0.10 | 0.10 | 0.10 | 0.10 | 0.11 | 0.11 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 4,395 | 4,395 | 4,395 | 4,395 | 4,395 | 4,395 | 4,395 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 15.88 | | | | | | |
| 2010 Irrigated Area | | ha | 1988 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 57.71 | 57.71 | 57.71 | 57.71 | 57.71 | 57.71 | 57.71 |
| | Dependability 90% | $Mm^3/yr$ | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 |
| | Dependability 75% | $Mm^3/yr$ | 7.90 | 7.90 | 7.90 | 7.90 | 7.90 | 7.90 | 7.90 |
| | Dependability 50% | $Mm^3/yr$ | 49.80 | 49.80 | 49.80 | 49.80 | 49.80 | 49.80 | 49.80 |
| | Dependability 25% | $Mm^3/yr$ | 106.70 | 106.70 | 106.70 | 106.70 | 106.70 | 106.70 | 106.70 |
| | Weighted Mean | $Mm^3/yr$ | 51.64 | 51.64 | 51.64 | 51.64 | 51.64 | 51.64 | 51.64 |
| Losses from Reservoir | Annual | % | 14.85 | | | | | | |
| | During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.04 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.43 | 0.43 | 1.29 | 1.29 | 2.15 | 2.15 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 21.02 | 20.78 | 20.78 | 20.31 | 20.31 | 19.83 | 19.83 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 12.33 | 12.19 | 12.19 | 11.92 | 11.92 | 11.65 | 11.65 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 |
| Dependability 50% | $Mm^3/yr$ | 17.79 | 17.58 | 17.58 | 17.14 | 17.14 | 16.70 | 16.70 |
| Dependability 25% | $Mm^3/yr$ | 17.79 | 17.58 | 17.58 | 17.14 | 17.14 | 16.70 | 16.70 |
| On-Farm Irrigation Efficiency | % | 57.01 | 70.00 | 57.01 | 70.00 | 57.01 | 70.00 | 57.01 |
| Off-Farm Irrigation Efficiency | % | 45.68 | 72.00 | 45.68 | 72.00 | 45.68 | 72.00 | 45.68 |
| Present Overall Irrigation Efficiency | % | 26.04 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 5.63 | 8.78 | 5.57 | 8.58 | 5.44 | 8.38 | 5.32 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 2.57 | 4.05 | 2.57 | 4.05 | 2.57 | 4.05 | 2.57 |
| Dependability 50% | $Mm^3/yr$ | 8.13 | 12.65 | 8.03 | 12.34 | 7.83 | 12.02 | 7.63 |
| Dependability 25% | $Mm^3/yr$ | 8.13 | 12.65 | 8.03 | 12.34 | 7.83 | 12.02 | 7.63 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 128 | 200 | 127 | 195 | 124 | 191 | 121 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 58 | 92 | 58 | 92 | 58 | 92 | 58 |
| Dependability 50% | mm/yr | 185 | 288 | 183 | 281 | 178 | 274 | 174 |
| Dependability 25% | mm/yr | 185 | 288 | 183 | 281 | 178 | 274 | 174 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 4.45 | 4.39 | 4.39 | 4.28 | 4.28 | 4.17 | 4.17 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 36.62 | 36.77 | 36.77 | 37.06 | 37.06 | 37.36 | 37.36 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 28.78 | 29.02 | 29.02 | 29.49 | 29.49 | 29.97 | 29.97 |
| Dependability 25% | $Mm^3/yr$ | 85.68 | 85.92 | 85.92 | 86.39 | 86.39 | 86.87 | 86.87 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 |
| Dependability 90% | $Mm^3/yr$ | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Dependability 75% | $Mm^3/yr$ | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 |
| Dependability 50% | $Mm^3/yr$ | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 |
| Dependability 25% | $Mm^3/yr$ | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.96 | 1.96 | 1.96 | 1.96 | 1.96 | 1.96 | 1.96 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 51.77 | | 51.77 | | 51.77 | | 51.77 |
| Weighted Mean | $Mm^3/yr$ | 6.38 | 4.39 | 6.31 | 4.29 | 6.17 | 4.19 | 6.03 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 2.91 | 2.03 | 2.91 | 2.03 | 2.91 | 2.03 | 2.91 |
| Dependability 50% | $Mm^3/yr$ | 9.21 | 6.33 | 9.10 | 6.17 | 8.87 | 6.01 | 8.64 |
| Dependability 25% | $Mm^3/yr$ | 9.21 | 6.33 | 9.10 | 6.17 | 8.87 | 6.01 | 8.64 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.50 | 0.29 | 0.44 | 0.27 | 0.41 | 0.26 | 0.39 |
| Dependability 90% | $Mm^3/yr$ | 0.50 | 0.29 | 0.44 | 0.27 | 0.41 | 0.26 | 0.39 |
| Dependability 75% | $Mm^3/yr$ | 0.50 | 0.29 | 0.44 | 0.27 | 0.41 | 0.26 | 0.39 |
| Dependability 50% | $Mm^3/yr$ | 0.50 | 0.29 | 0.44 | 0.27 | 0.41 | 0.26 | 0.39 |
| Dependability 25% | $Mm^3/yr$ | 0.50 | 0.29 | 0.44 | 0.27 | 0.41 | 0.26 | 0.39 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 6.88 | 4.68 | 6.75 | 4.56 | 6.58 | 4.45 | 6.42 |
| Dependability 90% | $Mm^3/yr$ | 0.50 | 0.29 | 0.44 | 0.27 | 0.41 | 0.26 | 0.39 |
| Dependability 75% | $Mm^3/yr$ | 3.42 | 2.32 | 3.35 | 2.30 | 3.32 | 2.29 | 3.30 |
| Dependability 50% | $Mm^3/yr$ | 9.71 | 6.62 | 9.54 | 6.44 | 9.28 | 6.27 | 9.03 |
| Dependability 25% | $Mm^3/yr$ | 9.71 | 6.62 | 9.54 | 6.44 | 9.28 | 6.27 | 9.03 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 90% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 50% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 25% | $Mm^3/yr$ | 0.03 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 6.91 | 4.73 | 6.79 | 4.62 | 6.63 | 4.51 | 6.48 |
| Dependability 90% | $Mm^3/yr$ | 0.53 | 0.34 | 0.48 | 0.33 | 0.46 | 0.32 | 0.45 |
| Dependability 75% | $Mm^3/yr$ | 3.44 | 2.36 | 3.40 | 2.35 | 3.38 | 2.35 | 3.36 |
| Dependability 50% | $Mm^3/yr$ | 9.74 | 6.66 | 9.58 | 6.50 | 9.33 | 6.33 | 9.09 |
| Dependability 25% | $Mm^3/yr$ | 9.74 | 6.66 | 9.58 | 6.50 | 9.33 | 6.33 | 9.09 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 8.58 | 6.19 | 8.25 | 5.98 | 7.99 | 5.81 | 7.78 |
| Dependability 90% | $Mm^3/yr$ | 2.20 | 1.80 | 1.94 | 1.69 | 1.82 | 1.62 | 1.75 |
| Dependability 75% | $Mm^3/yr$ | 5.11 | 3.83 | 4.86 | 3.71 | 4.74 | 3.65 | 4.66 |
| Dependability 50% | $Mm^3/yr$ | 11.41 | 8.13 | 11.04 | 7.86 | 10.69 | 7.63 | 10.39 |
| Dependability 25% | $Mm^3/yr$ | 11.41 | 8.13 | 11.04 | 7.86 | 10.69 | 7.63 | 10.39 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 8.58 | 6.19 | 8.25 | 5.98 | 7.99 | 5.81 | 7.78 |
| Dependability 90% | $Mm^3/yr$ | 2.20 | 1.80 | 1.94 | 1.69 | 1.82 | 1.62 | 1.75 |
| Dependability 75% | $Mm^3/yr$ | 5.11 | 3.83 | 4.86 | 3.71 | 4.74 | 3.65 | 4.66 |
| Dependability 50% | $Mm^3/yr$ | 11.41 | 8.13 | 11.04 | 7.86 | 10.69 | 7.63 | 10.39 |
| Dependability 25% | $Mm^3/yr$ | 11.41 | 8.13 | 11.04 | 7.86 | 10.69 | 7.63 | 10.39 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 195 | 141 | 188 | 136 | 182 | 132 | 177 |
| | Dependability 90% | mm/yr | 50 | 41 | 44 | 38 | 41 | 37 | 40 |
| | Dependability 75% | mm/yr | 116 | 87 | 111 | 85 | 108 | 83 | 106 |
| | Dependability 50% | mm/yr | 260 | 185 | 251 | 179 | 243 | 174 | 236 |
| | Dependability 25% | mm/yr | 260 | 185 | 251 | 179 | 243 | 174 | 236 |
| Well Yield | | $10^3 m^3/yr$ | 28 | | | | | | |
| No. of Irrigation Wells | Existing | | 592 | 592 | 592 | 592 | 592 | 592 | 592 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 16.68 | 16.68 | 16.68 | 16.68 | 16.68 | 16.68 | 16.68 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 14.21 | 14.97 | 13.82 | 14.56 | 13.44 | 14.20 | 13.10 |
| | Dependability 90% | $Mm^3/yr$ | 2.20 | 1.80 | 1.94 | 1.69 | 1.82 | 1.62 | 1.75 |
| | Dependability 75% | $Mm^3/yr$ | 7.68 | 7.88 | 7.43 | 7.77 | 7.31 | 7.70 | 7.23 |
| | Dependability 50% | $Mm^3/yr$ | 19.54 | 20.78 | 19.07 | 20.19 | 18.52 | 19.65 | 18.02 |
| | Dependability 25% | $Mm^3/yr$ | 19.54 | 20.78 | 19.07 | 20.19 | 18.52 | 19.65 | 18.02 |
| Depth | ted Mean | mm/yr | 323 | 341 | 315 | 331 | 306 | 323 | 298 |
| | Dependability 90% | mm/yr | 50 | 41 | 44 | 38 | 41 | 37 | 40 |
| | Dependability 75% | mm/yr | 175 | 179 | 169 | 177 | 166 | 175 | 165 |
| | Dependability 50% | mm/yr | 445 | 473 | 434 | 459 | 421 | 447 | 410 |
| | Dependability 25% | mm/yr | 445 | 473 | 434 | 459 | 421 | 447 | 410 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9100 | | | | | | |
| | Total | Mill.Rs. | | 39.99 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 39.99 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.51 | | | | | | |
| Average Annual Cost | Mill.Rs | 4.38 | 3.16 | 4.21 | 3.05 | 4.08 | 2.96 | 3.97 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 4.38 | 3.16 | 4.21 | 3.05 | 4.08 | 2.96 | 3.97 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 4.38 | 3.16 | 4.21 | 3.05 | 4.08 | 2.96 | 3.97 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.150 | 0.230 | 0.290 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Kothari Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | BHILWARA |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.15 | 0.23 | 0.29 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 4395 | 4395 | 4395 | 4395 | 4395 | 4395 | 4395 |
| SW On-Farm Irrigation Efficiency | % | 57.01 | 70.00 | 57.01 | 70.00 | 57.01 | 70.00 | 57.01 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 2.57 | 4.05 | 2.57 | 4.05 | 2.57 | 4.05 | 2.57 |
| Dependability 50% | $Mm^3/yr$ | 8.13 | 12.65 | 8.03 | 12.34 | 7.83 | 12.02 | 7.63 |
| Dependability 25% | $Mm^3/yr$ | 8.13 | 12.65 | 8.03 | 12.34 | 7.83 | 12.02 | 7.63 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.20 | 1.80 | 1.94 | 1.69 | 1.82 | 1.62 | 1.75 |
| Dependability 75% | $Mm^3/yr$ | 5.11 | 3.83 | 4.86 | 3.71 | 4.74 | 3.65 | 4.66 |
| Dependability 50% | $Mm^3/yr$ | 11.41 | 8.13 | 11.04 | 7.86 | 10.69 | 7.63 | 10.39 |
| Dependability 25% | $Mm^3/yr$ | 11.41 | 8.13 | 11.04 | 7.86 | 10.69 | 7.63 | 10.39 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.20 | 1.80 | 1.94 | 1.69 | 1.82 | 1.62 | 1.75 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 16.68 | 16.68 | 16.68 | 16.68 | 16.68 | 16.68 | 16.68 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 64.79 | 75.26 | 59.57 | 88.29 | 69.83 | 101.94 | 80.61 |
| CMLP Irrig. Intensity Dependability 90% | % | 8.42 | 8.54 | 7.98 | 7.76 | 7.25 | 7.45 | 6.97 |
| Dependability 75% | % | 28.26 | 36.18 | 29.30 | 34.57 | 27.94 | 34.25 | 27.65 |
| Dependability 50% | % | 71.34 | 95.19 | 74.81 | 89.71 | 70.47 | 87.29 | 68.56 |
| Dependability 25% | % | 71.48 | 95.47 | 75.03 | 89.95 | 70.66 | 87.52 | 68.74 |
| Weighted Mean | % | 52.04 | 68.71 | 54.39 | 64.82 | 51.27 | 63.19 | 49.97 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 65.46 | 47.30 | 64.67 | 47.03 | 64.37 | 46.56 | 64.01 |
| Dependability 50% | % | 54.48 | 35.04 | 55.45 | 36.44 | 56.25 | 36.36 | 56.19 |
| Dependability 25% | % | 53.01 | 33.66 | 53.33 | 34.95 | 55.79 | 35.60 | 55.73 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.41 | 0.00 | 4.41 | 0.00 | 4.41 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 4.38 | 7.57 | 4.21 | 7.46 | 4.08 | 7.38 | 3.97 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 4.41 | 0.00 | 4.41 | 0.00 | 4.41 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 4.38 | 7.57 | 4.21 | 7.46 | 4.08 | 7.38 | 3.97 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 64.79 | 75.26 | 59.57 | 88.29 | 69.83 | 101.94 | 80.61 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 8.79 | 10.79 | 8.54 | 10.49 | 8.30 | 10.23 | 8.09 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 14.21 | 14.97 | 13.82 | 14.56 | 13.44 | 14.20 | 13.10 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 | 1.47 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 100.85 | 93.81 | 7.04 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 91.79 | 84.75 | 7.04 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 9.06 | 9.06 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 486.32 | 384.89 | 101.43 |
| 5. Total Project Costs | Mill.Rs. | | 46.59 | 25.79 | 20.80 |
| 6. Project Capital Costs | Mill.Rs. | | 27.26 | 0.00 | 27.26 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 46.59 | 25.79 | 20.80 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 27.26 | 0.00 | 27.26 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 439.73 | 359.10 | 80.63 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.46 | 0.27 | |
| 2. Priority Sectors Use | % | | 8.98 | 9.66 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6202 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.73 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **3.96** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Lassadia Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Ajmer | Name(s): | |
| Groundwater Potential Zone (PZ) | Kekri | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 148 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 10.38 | Code: | |
| Present Dead Storage, $Mm^3$ | 0.52 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.07 | 0.15 | 0.15 | 0.19 | 0.19 | 0.21 | 0.21 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.09 | 0.09 | 0.09 | 0.10 | 0.10 | 0.11 | 0.11 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 2,080 | 2,080 | 2,080 | 2,080 | 2,080 | 2,080 | 2,080 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 13.72 | | | | | | |
| 2010 Irrigated Area | | ha | 6912 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 23.52 | 23.52 | 23.52 | 23.52 | 23.52 | 23.52 | 23.52 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 |
| | Dependability 50% | $Mm^3/yr$ | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 | 14.70 |
| | Dependability 25% | $Mm^3/yr$ | 34.00 | 34.00 | 34.00 | 34.00 | 34.00 | 34.00 | 34.00 |
| | Weighted Mean | $Mm^3/yr$ | 16.44 | 16.44 | 16.44 | 16.44 | 16.44 | 16.44 | 16.44 |
| Losses from Reservoir | Annual | % | 24.82 | | | | | | |
| | During the Rabi Season | % | 10.93 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.02 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.19 | 0.19 | 0.58 | 0.58 | 0.97 | 0.97 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 10.38 | 10.27 | 10.27 | 10.06 | 10.06 | 9.85 | 9.85 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 6.59 | 6.53 | 6.53 | 6.41 | 6.41 | 6.29 | 6.29 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 4.28 | 4.28 | 4.28 | 4.28 | 4.28 | 4.28 | 4.28 |
| Dependability 50% | $Mm^3/yr$ | 9.25 | 9.15 | 9.15 | 8.96 | 8.96 | 8.77 | 8.77 |
| Dependability 25% | $Mm^3/yr$ | 9.25 | 9.15 | 9.15 | 8.96 | 8.96 | 8.77 | 8.77 |
| On-Farm Irrigation Efficiency | % | 20.37 | 70.00 | 20.37 | 70.00 | 20.37 | 70.00 | 20.37 |
| Off-Farm Irrigation Efficiency | % | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 |
| Present Overall Irrigation Efficiency | % | 11.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 3.56 | 4.70 | 3.53 | 4.62 | 3.46 | 4.53 | 3.40 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 2.31 | 3.08 | 2.31 | 3.08 | 2.31 | 3.08 | 2.31 |
| Dependability 50% | $Mm^3/yr$ | 4.99 | 6.59 | 4.94 | 6.45 | 4.84 | 6.31 | 4.74 |
| Dependability 25% | $Mm^3/yr$ | 4.99 | 6.59 | 4.94 | 6.45 | 4.84 | 6.31 | 4.74 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 171 | 226 | 169 | 222 | 166 | 218 | 163 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 111 | 148 | 111 | 148 | 111 | 148 | 111 |
| Dependability 50% | mm/yr | 240 | 317 | 238 | 310 | 233 | 304 | 228 |
| Dependability 25% | mm/yr | 240 | 317 | 238 | 310 | 233 | 304 | 228 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.31 | 2.29 | 2.29 | 2.24 | 2.24 | 2.19 | 2.19 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 9.05 | 9.11 | 9.11 | 9.25 | 9.25 | 9.38 | 9.38 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 4.32 | 4.43 | 4.43 | 4.64 | 4.64 | 4.85 | 4.85 |
| Dependability 25% | $Mm^3/yr$ | 23.62 | 23.73 | 23.73 | 23.94 | 23.94 | 24.15 | 24.15 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 62.30 | | 62.30 | | 62.30 | | 62.30 |
| Weighted Mean | $Mm^3/yr$ | 4.10 | 2.35 | 4.07 | 2.31 | 3.99 | 2.27 | 3.92 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 2.66 | 1.54 | 2.66 | 1.54 | 2.66 | 1.54 | 2.66 |
| Dependability 50% | $Mm^3/yr$ | 5.76 | 3.29 | 5.70 | 3.23 | 5.58 | 3.16 | 5.46 |
| Dependability 25% | $Mm^3/yr$ | 5.76 | 3.29 | 5.70 | 3.23 | 5.58 | 3.16 | 5.46 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.07 | 0.03 | 0.05 | 0.02 | 0.03 | 0.02 | 0.02 |
| Dependability 90% | $Mm^3/yr$ | 0.07 | 0.03 | 0.05 | 0.02 | 0.03 | 0.02 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 0.07 | 0.03 | 0.05 | 0.02 | 0.03 | 0.02 | 0.02 |
| Dependability 50% | $Mm^3/yr$ | 0.07 | 0.03 | 0.05 | 0.02 | 0.03 | 0.02 | 0.02 |
| Dependability 25% | $Mm^3/yr$ | 0.07 | 0.03 | 0.05 | 0.02 | 0.03 | 0.02 | 0.02 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 4.18 | 2.38 | 4.12 | 2.33 | 4.03 | 2.28 | 3.95 |
| Dependability 90% | $Mm^3/yr$ | 0.07 | 0.03 | 0.05 | 0.02 | 0.03 | 0.02 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 2.74 | 1.57 | 2.71 | 1.56 | 2.70 | 1.56 | 2.69 |
| Dependability 50% | $Mm^3/yr$ | 5.83 | 3.33 | 5.75 | 3.25 | 5.62 | 3.17 | 5.49 |
| Dependability 25% | $Mm^3/yr$ | 5.83 | 3.33 | 5.75 | 3.25 | 5.62 | 3.17 | 5.49 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 90% | $Mm^3/yr$ | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 75% | $Mm^3/yr$ | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Dependability 25% | $Mm^3/yr$ | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 4.19 | 2.40 | 4.14 | 2.36 | 4.05 | 2.31 | 3.97 |
| Dependability 90% | $Mm^3/yr$ | 0.09 | 0.05 | 0.07 | 0.05 | 0.06 | 0.05 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 2.75 | 1.59 | 2.73 | 1.59 | 2.72 | 1.58 | 2.72 |
| Dependability 50% | $Mm^3/yr$ | 5.85 | 3.35 | 5.77 | 3.27 | 5.64 | 3.20 | 5.52 |
| Dependability 25% | $Mm^3/yr$ | 5.85 | 3.35 | 5.77 | 3.27 | 5.64 | 3.20 | 5.52 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 4.43 | 2.56 | 4.30 | 2.47 | 4.16 | 2.39 | 4.06 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.21 | 0.23 | 0.16 | 0.17 | 0.13 | 0.14 |
| Dependability 75% | $Mm^3/yr$ | 2.99 | 1.75 | 2.89 | 1.70 | 2.83 | 1.67 | 2.80 |
| Dependability 50% | $Mm^3/yr$ | 6.09 | 3.51 | 5.93 | 3.38 | 5.75 | 3.28 | 5.60 |
| Dependability 25% | $Mm^3/yr$ | 6.09 | 3.51 | 5.93 | 3.38 | 5.75 | 3.28 | 5.60 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 4.43 | 2.56 | 4.30 | 2.47 | 4.16 | 2.39 | 4.06 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.21 | 0.23 | 0.16 | 0.17 | 0.13 | 0.14 |
| Dependability 75% | $Mm^3/yr$ | 2.99 | 1.75 | 2.89 | 1.70 | 2.83 | 1.67 | 2.80 |
| Dependability 50% | $Mm^3/yr$ | 6.09 | 3.51 | 5.93 | 3.38 | 5.75 | 3.28 | 5.60 |
| Dependability 25% | $Mm^3/yr$ | 6.09 | 3.51 | 5.93 | 3.38 | 5.75 | 3.28 | 5.60 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 213 | 123 | 207 | 119 | 200 | 115 | 195 |
| | Dependability 90% | mm/yr | 16 | 10 | 11 | 8 | 8 | 6 | 7 |
| | Dependability 75% | mm/yr | 144 | 84 | 139 | 82 | 136 | 80 | 135 |
| | Dependability 50% | mm/yr | 293 | 169 | 285 | 163 | 277 | 158 | 269 |
| | Dependability 25% | mm/yr | 293 | 169 | 285 | 163 | 277 | 158 | 269 |
| Well Yield | | $10^3 m^3/yr$ | 29 | | | | | | |
| No. of Irrigation Wells | Existing | | 226 | 226 | 226 | 226 | 226 | 226 | 226 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 6.51 | 6.51 | 6.51 | 6.51 | 6.51 | 6.51 | 6.51 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 7.99 | 7.26 | 7.82 | 7.08 | 7.62 | 6.92 | 7.45 |
| | Dependability 90% | $Mm^3/yr$ | 0.33 | 0.21 | 0.23 | 0.16 | 0.17 | 0.13 | 0.14 |
| | Dependability 75% | $Mm^3/yr$ | 5.30 | 4.83 | 5.20 | 4.78 | 5.14 | 4.74 | 5.11 |
| | Dependability 50% | $Mm^3/yr$ | 11.08 | 10.10 | 10.87 | 9.84 | 10.59 | 9.60 | 10.34 |
| | Dependability 25% | $Mm^3/yr$ | 11.08 | 10.10 | 10.87 | 9.84 | 10.59 | 9.60 | 10.34 |
| Depth | ted Mean | mm/yr | 384 | 349 | 376 | 340 | 367 | 333 | 358 |
| | Dependability 90% | mm/yr | 16 | 10 | 11 | 8 | 8 | 6 | 7 |
| | Dependability 75% | mm/yr | 255 | 232 | 250 | 230 | 247 | 228 | 246 |
| | Dependability 50% | mm/yr | 533 | 485 | 523 | 473 | 509 | 462 | 497 |
| | Dependability 25% | mm/yr | 533 | 485 | 523 | 473 | 509 | 462 | 497 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9760 | | | | | | |
| | Total | Mill.Rs. | | 20.30 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 20.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.47 | | | | | | |
| Average Annual Cost | Mill.Rs | 2.08 | 1.21 | 2.02 | 1.16 | 1.96 | 1.12 | 1.91 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 2.08 | 1.21 | 2.02 | 1.16 | 1.96 | 1.12 | 1.91 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 2.08 | 1.21 | 2.02 | 1.16 | 1.96 | 1.12 | 1.91 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.200 | 0.290 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Lassadia Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Ajmer |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.2 | 0.29 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 2080 | 2080 | 2080 | 2080 | 2080 | 2080 | 2080 |
| SW On-Farm Irrigation Efficiency | % | 20.37 | 70.00 | 20.37 | 70.00 | 20.37 | 70.00 | 20.37 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 2.31 | 3.08 | 2.31 | 3.08 | 2.31 | 3.08 | 2.31 |
| Dependability 50% | $Mm^3/yr$ | 4.99 | 6.59 | 4.94 | 6.45 | 4.84 | 6.31 | 4.74 |
| Dependability 25% | $Mm^3/yr$ | 4.99 | 6.59 | 4.94 | 6.45 | 4.84 | 6.31 | 4.74 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.21 | 0.23 | 0.16 | 0.17 | 0.13 | 0.14 |
| Dependability 75% | $Mm^3/yr$ | 2.99 | 1.75 | 2.89 | 1.70 | 2.83 | 1.67 | 2.80 |
| Dependability 50% | $Mm^3/yr$ | 6.09 | 3.51 | 5.93 | 3.38 | 5.75 | 3.28 | 5.60 |
| Dependability 25% | $Mm^3/yr$ | 6.09 | 3.51 | 5.93 | 3.38 | 5.75 | 3.28 | 5.60 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.33 | 0.21 | 0.23 | 0.16 | 0.17 | 0.13 | 0.14 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 6.51 | 6.51 | 6.51 | 6.51 | 6.51 | 6.51 | 6.51 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 21.42 | 30.91 | 22.44 | 39.40 | 27.89 | 46.00 | 32.71 |
| CMLP Irrig. Intensity Dependability 90% | % | 2.69 | 2.00 | 1.87 | 1.46 | 1.35 | 1.17 | 1.08 |
| Dependability 75% | % | 30.65 | 42.67 | 29.44 | 41.32 | 28.48 | 40.57 | 28.21 |
| Dependability 50% | % | 63.38 | 85.40 | 61.06 | 82.39 | 58.41 | 79.96 | 56.93 |
| Dependability 25% | % | 63.52 | 85.40 | 61.17 | 82.39 | 58.52 | 79.96 | 57.04 |
| Weighted Mean | % | 45.96 | 61.84 | 44.12 | 59.61 | 42.19 | 57.90 | 41.17 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 55.68 | 33.38 | 54.77 | 33.38 | 54.32 | 33.38 | 52.96 |
| Dependability 50% | % | 52.71 | 28.37 | 52.01 | 28.37 | 52.09 | 28.37 | 51.94 |
| Dependability 25% | % | 51.89 | 25.42 | 51.01 | 25.42 | 51.27 | 25.42 | 51.12 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 2.24 | 0.00 | 2.24 | 0.00 | 2.24 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 2.08 | 3.45 | 2.02 | 3.40 | 1.96 | 3.36 | 1.91 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 2.24 | 0.00 | 2.24 | 0.00 | 2.24 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 2.08 | 3.45 | 2.02 | 3.40 | 1.96 | 3.36 | 1.91 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 21.42 | 30.91 | 22.44 | 39.40 | 27.89 | 46.00 | 32.71 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 3.60 | 5.21 | 3.51 | 5.08 | 3.41 | 4.97 | 3.33 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 7.99 | 7.26 | 7.82 | 7.08 | 7.62 | 6.92 | 7.45 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 44.57 | 47.99 | -3.42 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 44.57 | 47.99 | -3.42 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 204.48 | 147.40 | 57.07 |
| 5. Total Project Costs | Mill.Rs. | | 21.20 | 12.37 | 8.83 |
| 6. Project Capital Costs | Mill.Rs. | | 13.84 | 0.00 | 13.84 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 21.20 | 12.37 | 8.83 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 13.84 | 0.00 | 13.84 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 183.27 | 135.03 | 48.24 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.48 | 0.26 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6652 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 3.27 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **4.49** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Madhosagar Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | 2040 | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banganga | Linked to Project(s): | |
| District | Dusa | Name(s): | Morli bund |
| Groundwater Potential Zone (PZ) | Dusa | Code(s): | 2039 |
| Unintercepted Catchment Area, $km^2$ | 75.4 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 21.4 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.66 | 1.29 | 1.29 | 1.76 | 1.76 | 1.99 | 1.99 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.37 | 0.41 | 0.41 | 0.49 | 0.49 | 0.58 | 0.58 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,232 | 3,232 | 3,232 | 3,232 | 3,232 | 3,232 | 3,232 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 0.00 | | | | | | |
| 2010 Irrigated Area | | ha | 0 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 7.72 | 7.72 | 7.72 | 7.72 | 7.72 | 7.72 | 7.72 |
| | Dependability 90% | $Mm^3/yr$ | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| | Dependability 75% | $Mm^3/yr$ | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 |
| | Dependability 50% | $Mm^3/yr$ | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 |
| | Dependability 25% | $Mm^3/yr$ | 10.60 | 10.60 | 10.60 | 10.60 | 10.60 | 10.60 | 10.60 |
| | Weighted Mean | $Mm^3/yr$ | 6.44 | 6.44 | 6.44 | 6.44 | 6.44 | 6.44 | 6.44 |
| Losses from Reservoir | Annual | % | 24.82 | | | | | | |
| | During the Rabi Season | % | 10.93 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.01 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.10 | 0.10 | 0.30 | 0.30 | 0.49 | 0.49 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 21.40 | 21.30 | 21.30 | 21.10 | 21.10 | 20.91 | 20.91 |
| Import: | Mean | $Mm^3/yr$ | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 |
| | Dependability 90% | $Mm^3/yr$ | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 |
| | Dependability 75% | $Mm^3/yr$ | 1.01 | 1.01 | 1.01 | 1.01 | 1.01 | 1.01 | 1.01 |
| | Dependability 50% | $Mm^3/yr$ | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 |
| | Dependability 25% | $Mm^3/yr$ | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 | 2.76 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 7.31 | 7.31 | 7.31 | 7.31 | 7.31 | 7.31 | 7.31 |
| Dependability 90% | $Mm^3/yr$ | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 |
| Dependability 75% | $Mm^3/yr$ | 3.66 | 3.66 | 3.66 | 3.66 | 3.66 | 3.66 | 3.66 |
| Dependability 50% | $Mm^3/yr$ | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 | 7.68 |
| Dependability 25% | $Mm^3/yr$ | 11.90 | 11.90 | 11.90 | 11.90 | 11.90 | 11.90 | 11.90 |
| On-Farm Irrigation Efficiency | % | 10.00 | 70.00 | 10.00 | 70.00 | 10.00 | 70.00 | 10.00 |
| Off-Farm Irrigation Efficiency | % | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 |
| Present Overall Irrigation Efficiency | % | 5.40 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 3.95 | 5.26 | 3.95 | 5.26 | 3.95 | 5.26 | 3.95 |
| Dependability 90% | $Mm^3/yr$ | 0.68 | 0.90 | 0.68 | 0.90 | 0.68 | 0.90 | 0.68 |
| Dependability 75% | $Mm^3/yr$ | 1.98 | 2.64 | 1.98 | 2.64 | 1.98 | 2.64 | 1.98 |
| Dependability 50% | $Mm^3/yr$ | 4.15 | 5.53 | 4.15 | 5.53 | 4.15 | 5.53 | 4.15 |
| Dependability 25% | $Mm^3/yr$ | 6.43 | 8.57 | 6.43 | 8.57 | 6.43 | 8.57 | 6.43 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 122 | 163 | 122 | 163 | 122 | 163 | 122 |
| Dependability 90% | mm/yr | 21 | 28 | 21 | 28 | 21 | 28 | 21 |
| Dependability 75% | mm/yr | 61 | 82 | 61 | 82 | 61 | 82 | 61 |
| Dependability 50% | mm/yr | 128 | 171 | 128 | 171 | 128 | 171 | 128 |
| Dependability 25% | mm/yr | 199 | 265 | 199 | 265 | 199 | 265 | 199 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.97 | 2.97 | 2.97 | 2.97 | 2.97 | 2.97 | 2.97 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 8.32 | 8.32 | 8.32 | 8.32 | 8.32 | 8.32 | 8.32 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 66.22 | | 66.22 | | 66.22 | | 66.22 |
| Weighted Mean | $Mm^3/yr$ | 4.84 | 2.63 | 4.84 | 2.63 | 4.84 | 2.63 | 4.84 |
| Dependability 90% | $Mm^3/yr$ | 0.83 | 0.45 | 0.83 | 0.45 | 0.83 | 0.45 | 0.83 |
| Dependability 75% | $Mm^3/yr$ | 2.42 | 1.32 | 2.42 | 1.32 | 2.42 | 1.32 | 2.42 |
| Dependability 50% | $Mm^3/yr$ | 5.08 | 2.76 | 5.08 | 2.76 | 5.08 | 2.76 | 5.08 |
| Dependability 25% | $Mm^3/yr$ | 7.88 | 4.28 | 7.88 | 4.28 | 7.88 | 4.28 | 7.88 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 2.19 | 1.32 | 1.99 | 1.21 | 1.82 | 1.15 | 1.73 |
| Dependability 90% | $Mm^3/yr$ | 2.19 | 1.32 | 1.99 | 1.21 | 1.82 | 1.15 | 1.73 |
| Dependability 75% | $Mm^3/yr$ | 2.19 | 1.32 | 1.99 | 1.21 | 1.82 | 1.15 | 1.73 |
| Dependability 50% | $Mm^3/yr$ | 2.19 | 1.32 | 1.99 | 1.21 | 1.82 | 1.15 | 1.73 |
| Dependability 25% | $Mm^3/yr$ | 2.19 | 1.32 | 1.99 | 1.21 | 1.82 | 1.15 | 1.73 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 7.03 | 3.96 | 6.83 | 3.85 | 6.66 | 3.78 | 6.57 |
| Dependability 90% | $Mm^3/yr$ | 3.02 | 1.78 | 2.82 | 1.67 | 2.65 | 1.60 | 2.56 |
| Dependability 75% | $Mm^3/yr$ | 4.61 | 2.64 | 4.41 | 2.53 | 4.25 | 2.47 | 4.15 |
| Dependability 50% | $Mm^3/yr$ | 7.27 | 4.09 | 7.07 | 3.98 | 6.91 | 3.91 | 6.81 |
| Dependability 25% | $Mm^3/yr$ | 10.07 | 5.61 | 9.87 | 5.50 | 9.70 | 5.43 | 9.61 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.20 | 0.20 | 0.23 | 0.23 |
| Dependability 90% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.20 | 0.20 | 0.23 | 0.23 |
| Dependability 75% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.20 | 0.20 | 0.23 | 0.23 |
| Dependability 50% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.20 | 0.20 | 0.23 | 0.23 |
| Dependability 25% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.20 | 0.20 | 0.23 | 0.23 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 7.12 | 4.11 | 6.98 | 4.05 | 6.87 | 4.02 | 6.80 |
| Dependability 90% | $Mm^3/yr$ | 3.11 | 1.93 | 2.97 | 1.87 | 2.86 | 1.84 | 2.79 |
| Dependability 75% | $Mm^3/yr$ | 4.70 | 2.80 | 4.56 | 2.74 | 4.45 | 2.70 | 4.38 |
| Dependability 50% | $Mm^3/yr$ | 7.36 | 4.24 | 7.22 | 4.18 | 7.11 | 4.15 | 7.04 |
| Dependability 25% | $Mm^3/yr$ | 10.16 | 5.76 | 10.02 | 5.70 | 9.91 | 5.67 | 9.84 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 14.41 | 10.73 | 13.60 | 10.12 | 12.94 | 9.77 | 12.55 |
| Dependability 90% | $Mm^3/yr$ | 10.40 | 8.55 | 9.59 | 7.94 | 8.93 | 7.59 | 8.54 |
| Dependability 75% | $Mm^3/yr$ | 11.99 | 9.42 | 11.18 | 8.81 | 10.52 | 8.45 | 10.13 |
| Dependability 50% | $Mm^3/yr$ | 14.65 | 10.86 | 13.84 | 10.25 | 13.18 | 9.90 | 12.79 |
| Dependability 25% | $Mm^3/yr$ | 17.45 | 12.38 | 16.64 | 11.77 | 15.98 | 11.42 | 15.59 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 14.41 | 10.73 | 13.60 | 10.12 | 12.94 | 9.77 | 12.55 |
| Dependability 90% | $Mm^3/yr$ | 10.40 | 8.55 | 9.59 | 7.94 | 8.93 | 7.59 | 8.54 |
| Dependability 75% | $Mm^3/yr$ | 11.99 | 9.42 | 11.18 | 8.81 | 10.52 | 8.45 | 10.13 |
| Dependability 50% | $Mm^3/yr$ | 14.65 | 10.86 | 13.84 | 10.25 | 13.18 | 9.90 | 12.79 |
| Dependability 25% | $Mm^3/yr$ | 17.45 | 12.38 | 16.64 | 11.77 | 15.98 | 11.42 | 15.59 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 446 | 332 | 421 | 313 | 400 | 302 | 388 |
| | Dependability 90% | mm/yr | 322 | 265 | 297 | 246 | 276 | 235 | 264 |
| | Dependability 75% | mm/yr | 371 | 291 | 346 | 272 | 325 | 261 | 314 |
| | Dependability 50% | mm/yr | 453 | 336 | 428 | 317 | 408 | 306 | 396 |
| | Dependability 25% | mm/yr | 540 | 383 | 515 | 364 | 494 | 353 | 482 |
| Well Yield | | $10^3 m^3/yr$ | 23 | | | | | | |
| No. of Irrigation Wells | Existing | | 1361 | 1361 | 1361 | 1361 | 1361 | 1361 | 1361 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 30.95 | 30.95 | 30.95 | 30.95 | 30.95 | 30.95 | 30.95 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 18.36 | 15.99 | 17.55 | 15.38 | 16.88 | 15.03 | 16.50 |
| | Dependability 90% | $Mm^3/yr$ | 11.08 | 9.45 | 10.27 | 8.84 | 9.61 | 8.49 | 9.22 |
| | Dependability 75% | $Mm^3/yr$ | 13.97 | 12.05 | 13.16 | 11.44 | 12.50 | 11.09 | 12.11 |
| | Dependability 50% | $Mm^3/yr$ | 18.80 | 16.39 | 17.99 | 15.78 | 17.33 | 15.43 | 16.94 |
| | Dependability 25% | $Mm^3/yr$ | 23.88 | 20.95 | 23.07 | 20.34 | 22.40 | 19.99 | 22.01 |
| Depth | ted Mean | mm/yr | 568 | 495 | 543 | 476 | 522 | 465 | 510 |
| | Dependability 90% | mm/yr | 343 | 293 | 318 | 274 | 297 | 263 | 285 |
| | Dependability 75% | mm/yr | 432 | 373 | 407 | 354 | 387 | 343 | 375 |
| | Dependability 50% | mm/yr | 582 | 507 | 557 | 488 | 536 | 477 | 524 |
| | Dependability 25% | mm/yr | 739 | 648 | 714 | 629 | 693 | 618 | 681 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 16724 | | | | | | |
| | Total | Mill.Rs. | | 54.05 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 54.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.76 | | | | | | |
| Average Annual Cost | Mill.Rs | 10.95 | 8.16 | 10.34 | 7.69 | 9.83 | 7.42 | 9.54 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 10.95 | 8.16 | 10.34 | 7.69 | 9.83 | 7.42 | 9.54 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 10.95 | 8.16 | 10.34 | 7.69 | 9.83 | 7.42 | 9.54 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.150 | 0.230 | 0.260 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Madhosagar Irrigation Project |
| WRIS Project Code: | 2040 |
| Status: | Existing |
| River Basin: | Banganga |
| Irrigation Demand Zone (IDZ) | Dusa |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.15 | 0.23 | 0.26 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3232 | 3232 | 3232 | 3232 | 3232 | 3232 | 3232 |
| SW On-Farm Irrigation Efficiency | % | 10.00 | 70.00 | 10.00 | 70.00 | 10.00 | 70.00 | 10.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.68 | 0.90 | 0.68 | 0.90 | 0.68 | 0.90 | 0.68 |
| Dependability 75% | $Mm^3/yr$ | 1.98 | 2.64 | 1.98 | 2.64 | 1.98 | 2.64 | 1.98 |
| Dependability 50% | $Mm^3/yr$ | 4.15 | 5.53 | 4.15 | 5.53 | 4.15 | 5.53 | 4.15 |
| Dependability 25% | $Mm^3/yr$ | 6.43 | 8.57 | 6.43 | 8.57 | 6.43 | 8.57 | 6.43 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 10.40 | 8.55 | 9.59 | 7.94 | 8.93 | 7.59 | 8.54 |
| Dependability 75% | $Mm^3/yr$ | 11.99 | 9.42 | 11.18 | 8.81 | 10.52 | 8.45 | 10.13 |
| Dependability 50% | $Mm^3/yr$ | 14.65 | 10.86 | 13.84 | 10.25 | 13.18 | 9.90 | 12.79 |
| Dependability 25% | $Mm^3/yr$ | 17.45 | 12.38 | 16.64 | 11.77 | 15.98 | 11.42 | 15.59 |
| Firm GW for Kharif | $Mm^3/yr$ | 10.40 | 8.55 | 9.59 | 7.94 | 8.93 | 7.59 | 8.54 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 30.95 | 30.95 | 30.95 | 30.95 | 30.95 | 30.95 | 30.95 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 96.75 | 105.69 | 92.83 | 133.92 | 113.57 | 159.57 | 134.64 |
| CMLP Irrig. Intensity Dependability 90% | % | 82.90 | 85.53 | 76.51 | 71.50 | 63.71 | 68.61 | 60.98 |
| Dependability 75% | % | 97.36 | 108.48 | 90.95 | 91.99 | 76.59 | 89.09 | 73.85 |
| Dependability 50% | % | 121.77 | 149.07 | 115.28 | 126.77 | 98.18 | 123.74 | 95.43 |
| Dependability 25% | % | 149.27 | 166.67 | 142.25 | 166.67 | 121.11 | 166.67 | 118.27 |
| Weighted Mean | % | 120.23 | 136.54 | 113.58 | 124.84 | 96.30 | 122.95 | 93.52 |
| CMLP GW Use Dependability 90% | % | 93.88 | 90.44 | 93.40 | 89.78 | 92.94 | 89.35 | 92.64 |
| Dependability 75% | % | 85.50 | 77.99 | 84.61 | 76.85 | 83.92 | 76.10 | 83.40 |
| Dependability 50% | % | 76.56 | 63.61 | 75.59 | 63.46 | 75.13 | 62.74 | 77.84 |
| Dependability 25% | % | 68.96 | 60.40 | 68.39 | 56.27 | 74.83 | 53.88 | 73.81 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.96 | 0.00 | 5.96 | 0.00 | 5.96 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 10.95 | 14.12 | 10.34 | 13.66 | 9.83 | 13.39 | 9.54 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.96 | 0.00 | 5.96 | 0.00 | 5.96 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 10.95 | 14.12 | 10.34 | 13.66 | 9.83 | 13.39 | 9.54 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 96.75 | 105.69 | 92.83 | 133.92 | 113.57 | 159.57 | 134.64 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 9.76 | 11.73 | 9.24 | 11.27 | 8.80 | 11.01 | 8.55 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 18.36 | 15.99 | 17.55 | 15.38 | 16.88 | 15.03 | 16.50 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 97.83 | 107.35 | -9.52 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 97.83 | 107.35 | -9.52 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 698.64 | 607.46 | 91.19 |
| 5. Total Project Costs | Mill.Rs. | | 86.48 | 63.06 | 23.42 |
| 6. Project Capital Costs | Mill.Rs. | | 36.84 | 0.00 | 36.84 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 86.48 | 63.06 | 23.42 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 36.84 | 0.00 | 36.84 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 612.16 | 544.40 | 67.76 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.88 | 0.59 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 11398 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.78 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **2.84** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Mahi Bajaj Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | MAHI | Linked to Project(s): | |
| District | BANSWARA,DUNGARPUR,PRATAPGARH | Name(s): | |
| Groundwater Potential Zone (PZ) | | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 6088 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 1807.83 | Code: | |
| Present Dead Storage, $Mm^3$ | 315.03 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 4.240 | 4.240 | 4.240 | 4.240 | 4.240 | 4.240 | 4.240 |
| | From GW | $Mm^3/yr$ | 1.66 | 1.77 | 1.77 | 2.36 | 2.36 | 4.60 | 4.60 |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 12.35 | 27.31 | 27.31 | 37.22 | 37.22 | 43.02 | 43.02 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 1.922 | 1.922 | 1.922 | 1.922 | 1.922 | 1.922 | 1.922 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 7.18 | 7.49 | 7.49 | 8.09 | 8.09 | 8.72 | 8.72 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 | 80,000 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 1755.00 | | | | | | |
| 2010 Irrigated Area | | ha | 525102 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 3077.55 | 3077.55 | 3077.55 | 3077.55 | 3077.55 | 3077.55 | 3077.55 |
| | Dependability 90% | $Mm^3/yr$ | 899.70 | 899.70 | 899.70 | 899.70 | 899.70 | 899.70 | 899.70 |
| | Dependability 75% | $Mm^3/yr$ | 1964.20 | 1964.20 | 1964.20 | 1964.20 | 1964.20 | 1964.20 | 1964.20 |
| | Dependability 50% | $Mm^3/yr$ | 3009.90 | 3009.80 | 3009.90 | 3009.80 | 3009.90 | 3009.80 | 3009.90 |
| | Dependability 25% | $Mm^3/yr$ | 4009.20 | 4009.20 | 4009.20 | 4009.20 | 4009.20 | 4009.20 | 4009.20 |
| | Weighted Mean | $Mm^3/yr$ | 2803.54 | 2803.51 | 2803.54 | 2803.51 | 2803.54 | 2803.51 | 2803.54 |
| Losses from Reservoir | Annual | % | 7.46 | | | | | | |
| | During the Rabi Season | % | 3.40 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 350.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 2.13 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 21.31 | 21.31 | 63.92 | 63.92 | 106.54 | 106.54 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 1807.83 | 1796.11 | 1796.11 | 1772.67 | 1772.67 | 1749.23 | 1749.23 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 459.53 | 456.78 | 456.78 | 451.28 | 451.28 | 445.78 | 445.78 |
| Dependability 90% | $Mm^3/yr$ | 246.48 | 246.48 | 246.48 | 246.48 | 246.48 | 246.48 | 246.48 |
| Dependability 75% | $Mm^3/yr$ | 497.12 | 493.89 | 493.89 | 487.42 | 487.42 | 480.95 | 480.95 |
| Dependability 50% | $Mm^3/yr$ | 497.12 | 493.89 | 493.89 | 487.42 | 487.42 | 480.95 | 480.95 |
| Dependability 25% | $Mm^3/yr$ | 497.12 | 493.89 | 493.89 | 487.42 | 487.42 | 480.95 | 480.95 |
| On-Farm Irrigation Efficiency | % | 50.00 | 70.00 | 50.00 | 70.00 | 50.00 | 70.00 | 50.00 |
| Off-Farm Irrigation Efficiency | % | 67.00 | 72.00 | 67.00 | 72.00 | 67.00 | 72.00 | 67.00 |
| Present Overall Irrigation Efficiency | % | 33.50 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 307.88 | 328.88 | 306.04 | 324.92 | 302.36 | 320.96 | 298.67 |
| Dependability 90% | $Mm^3/yr$ | 165.14 | 177.47 | 165.14 | 177.47 | 165.14 | 177.47 | 165.14 |
| Dependability 75% | $Mm^3/yr$ | 333.07 | 355.60 | 330.91 | 350.94 | 326.57 | 346.28 | 322.24 |
| Dependability 50% | $Mm^3/yr$ | 333.07 | 355.60 | 330.91 | 350.94 | 326.57 | 346.28 | 322.24 |
| Dependability 25% | $Mm^3/yr$ | 333.07 | 355.60 | 330.91 | 350.94 | 326.57 | 346.28 | 322.24 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 385 | 411 | 383 | 406 | 378 | 401 | 373 |
| Dependability 90% | mm/yr | 206 | 222 | 206 | 222 | 206 | 222 | 206 |
| Dependability 75% | mm/yr | 416 | 444 | 414 | 439 | 408 | 433 | 403 |
| Dependability 50% | mm/yr | 416 | 444 | 414 | 439 | 408 | 433 | 403 |
| Dependability 25% | mm/yr | 416 | 444 | 414 | 439 | 408 | 433 | 403 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 124.28 | 123.47 | 123.47 | 121.85 | 121.85 | 120.24 | 120.24 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 1131.93 | 1141.86 | 1141.89 | 1161.78 | 1161.82 | 1181.71 | 1181.74 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 156.37 | 168.09 | 168.09 | 191.53 | 191.53 | 214.97 | 214.97 |
| Dependability 50% | $Mm^3/yr$ | 1202.07 | 1213.69 | 1213.79 | 1237.13 | 1237.23 | 1260.57 | 1260.67 |
| Dependability 25% | $Mm^3/yr$ | 2201.37 | 2213.09 | 2213.09 | 2236.53 | 2236.53 | 2259.97 | 2259.97 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 |
| Dependability 90% | $Mm^3/yr$ | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 |
| Dependability 75% | $Mm^3/yr$ | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 |
| Dependability 50% | $Mm^3/yr$ | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 |
| Dependability 25% | $Mm^3/yr$ | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 | 4.24 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 |
| Dependability 90% | $Mm^3/yr$ | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 |
| Dependability 75% | $Mm^3/yr$ | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 |
| Dependability 50% | $Mm^3/yr$ | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 |
| Dependability 25% | $Mm^3/yr$ | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 58.77 | 58.77 | 58.77 | 58.77 | 58.77 | 58.77 | 58.77 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 46.55 | | 46.55 | | 46.55 | | 46.55 |
| Weighted Mean | $Mm^3/yr$ | 213.91 | 164.44 | 212.63 | 162.46 | 210.07 | 160.48 | 207.51 |
| Dependability 90% | $Mm^3/yr$ | 114.74 | 88.73 | 114.74 | 88.73 | 114.74 | 88.73 | 114.74 |
| Dependability 75% | $Mm^3/yr$ | 231.41 | 177.80 | 229.91 | 175.47 | 226.89 | 173.14 | 223.88 |
| Dependability 50% | $Mm^3/yr$ | 231.41 | 177.80 | 229.91 | 175.47 | 226.89 | 173.14 | 223.88 |
| Dependability 25% | $Mm^3/yr$ | 231.41 | 177.80 | 229.91 | 175.47 | 226.89 | 173.14 | 223.88 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 11.27 | 4.44 | 6.66 | 2.22 | 3.33 | 0.49 | 0.73 |
| Dependability 90% | $Mm^3/yr$ | 11.27 | 4.44 | 6.66 | 2.22 | 3.33 | 0.49 | 0.73 |
| Dependability 75% | $Mm^3/yr$ | 11.27 | 4.44 | 6.66 | 2.22 | 3.33 | 0.49 | 0.73 |
| Dependability 50% | $Mm^3/yr$ | 11.27 | 4.44 | 6.66 | 2.22 | 3.33 | 0.49 | 0.73 |
| Dependability 25% | $Mm^3/yr$ | 11.27 | 4.44 | 6.66 | 2.22 | 3.33 | 0.49 | 0.73 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 225.18 | 168.88 | 219.29 | 164.68 | 213.40 | 160.97 | 208.24 |
| Dependability 90% | $Mm^3/yr$ | 126.01 | 93.17 | 121.40 | 90.95 | 118.07 | 89.22 | 115.47 |
| Dependability 75% | $Mm^3/yr$ | 242.68 | 182.24 | 236.57 | 177.69 | 230.22 | 173.63 | 224.61 |
| Dependability 50% | $Mm^3/yr$ | 242.68 | 182.24 | 236.57 | 177.69 | 230.22 | 173.63 | 224.61 |
| Dependability 25% | $Mm^3/yr$ | 242.68 | 182.24 | 236.57 | 177.69 | 230.22 | 173.63 | 224.61 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 3.14 | 4.48 | 4.48 | 5.40 | 5.40 | 6.18 | 6.18 |
| Dependability 90% | $Mm^3/yr$ | 3.14 | 4.48 | 4.48 | 5.40 | 5.40 | 6.18 | 6.18 |
| Dependability 75% | $Mm^3/yr$ | 3.14 | 4.48 | 4.48 | 5.40 | 5.40 | 6.18 | 6.18 |
| Dependability 50% | $Mm^3/yr$ | 3.14 | 4.48 | 4.48 | 5.40 | 5.40 | 6.18 | 6.18 |
| Dependability 25% | $Mm^3/yr$ | 3.14 | 4.48 | 4.48 | 5.40 | 5.40 | 6.18 | 6.18 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 228.32 | 173.36 | 223.77 | 170.08 | 218.80 | 167.14 | 214.42 |
| Dependability 90% | $Mm^3/yr$ | 129.15 | 97.65 | 125.87 | 96.35 | 123.46 | 95.40 | 121.64 |
| Dependability 75% | $Mm^3/yr$ | 245.82 | 186.72 | 241.04 | 183.09 | 235.62 | 179.81 | 230.79 |
| Dependability 50% | $Mm^3/yr$ | 245.82 | 186.72 | 241.04 | 183.09 | 235.62 | 179.81 | 230.79 |
| Dependability 25% | $Mm^3/yr$ | 245.82 | 186.72 | 241.04 | 183.09 | 235.62 | 179.81 | 230.79 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 265.90 | 195.56 | 245.97 | 181.18 | 229.90 | 169.57 | 216.85 |
| Dependability 90% | $Mm^3/yr$ | 166.73 | 119.85 | 148.07 | 107.45 | 134.56 | 97.83 | 124.07 |
| Dependability 75% | $Mm^3/yr$ | 283.40 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Dependability 50% | $Mm^3/yr$ | 283.40 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Dependability 25% | $Mm^3/yr$ | 283.40 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 116.12 | 195.56 | 245.97 | 181.18 | 229.90 | 169.57 | 216.85 |
| Dependability 90% | $Mm^3/yr$ | 116.12 | 119.85 | 148.07 | 107.45 | 134.56 | 97.83 | 124.07 |
| Dependability 75% | $Mm^3/yr$ | 116.12 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Dependability 50% | $Mm^3/yr$ | 116.12 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Dependability 25% | $Mm^3/yr$ | 116.12 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 145 | 244 | 307 | 226 | 287 | 212 | 271 |
| | Dependability 90% | mm/yr | 145 | 150 | 185 | 134 | 168 | 122 | 155 |
| | Dependability 75% | mm/yr | 145 | 261 | 329 | 243 | 308 | 228 | 292 |
| | Dependability 50% | mm/yr | 145 | 261 | 329 | 243 | 308 | 228 | 292 |
| | Dependability 25% | mm/yr | 145 | 261 | 329 | 243 | 308 | 228 | 292 |
| Well Yield | | $10^3 m^3/yr$ | 29 | | | | | | |
| No. of Irrigation Wells | Existing | | 4066 | 4066 | 4066 | 8902 | 11197 | 8902 | 11197 |
| | Additional | | | 4836 | 7131 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 116.12 | 254.24 | 319.79 | 254.24 | 319.79 | 254.24 | 319.79 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 23.22 | 50.85 | 63.96 | 50.85 | 63.96 | 50.85 | 63.96 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 424.01 | 524.44 | 552.01 | 506.10 | 532.25 | 490.54 | 515.52 |
| | Dependability 90% | $Mm^3/yr$ | 281.27 | 297.32 | 313.22 | 284.91 | 299.70 | 275.29 | 289.21 |
| | Dependability 75% | $Mm^3/yr$ | 449.20 | 564.52 | 594.15 | 545.13 | 573.29 | 528.52 | 555.46 |
| | Dependability 50% | $Mm^3/yr$ | 449.20 | 564.52 | 594.15 | 545.13 | 573.29 | 528.52 | 555.46 |
| | Dependability 25% | $Mm^3/yr$ | 449.20 | 564.52 | 594.15 | 545.13 | 573.29 | 528.52 | 555.46 |
| Depth | ted Mean | mm/yr | 530 | 656 | 690 | 633 | 665 | 613 | 644 |
| | Dependability 90% | mm/yr | 352 | 372 | 392 | 356 | 375 | 344 | 362 |
| | Dependability 75% | mm/yr | 561 | 706 | 743 | 681 | 717 | 661 | 694 |
| | Dependability 50% | mm/yr | 561 | 706 | 743 | 681 | 717 | 661 | 694 |
| | Dependability 25% | mm/yr | 561 | 706 | 743 | 681 | 717 | 661 | 694 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.23 | 0.94 | 0.94 | 1.86 | 1.86 | 4.42 | 4.42 |
| | Annual Irrigation Depth | mm | 0.28 | 1.17 | 1.17 | 2.33 | 2.33 | 5.53 | 5.53 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 8550 | | | | | | |
| | Total | Mill.Rs. | | 684.00 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | 68 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 331.04 | 488.15 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | 18 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 87.05 | 128.36 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 1102.09 | 616.50 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 3.31 | 4.88 | 3.31 | 4.88 | 3.31 | 4.88 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 4.35 | 6.42 | 4.35 | 6.42 | 4.35 | 6.42 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.43 | | | | | | |
| Average Annual Cost | Mill.Rs | 49.93 | 84.09 | 105.77 | 77.91 | 98.86 | 72.92 | 93.24 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 49.93 | 84.09 | 105.77 | 77.91 | 98.86 | 72.92 | 93.24 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 49.93 | 91.75 | 117.07 | 85.57 | 110.15 | 80.58 | 104.54 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.150 | 0.210 | 0.310 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Mahi Bajaj Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | MAHI |
| Irrigation Demand Zone (IDZ) | BANSWARA,DUNGARPUR,PRATAPGARH |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.15 | 0.21 | 0.31 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 |
| SW On-Farm Irrigation Efficiency | % | 50.00 | 70.00 | 50.00 | 70.00 | 50.00 | 70.00 | 50.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 165.14 | 177.47 | 165.14 | 177.47 | 165.14 | 177.47 | 165.14 |
| Dependability 75% | $Mm^3/yr$ | 333.07 | 355.60 | 330.91 | 350.94 | 326.57 | 346.28 | 322.24 |
| Dependability 50% | $Mm^3/yr$ | 333.07 | 355.60 | 330.91 | 350.94 | 326.57 | 346.28 | 322.24 |
| Dependability 25% | $Mm^3/yr$ | 333.07 | 355.60 | 330.91 | 350.94 | 326.57 | 346.28 | 322.24 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 166.73 | 119.85 | 148.07 | 107.45 | 134.56 | 97.83 | 124.07 |
| Dependability 75% | $Mm^3/yr$ | 283.40 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Dependability 50% | $Mm^3/yr$ | 283.40 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Dependability 25% | $Mm^3/yr$ | 283.40 | 208.92 | 263.24 | 194.19 | 246.72 | 182.24 | 233.22 |
| Firm GW for Kharif | $Mm^3/yr$ | 166.73 | 119.85 | 148.07 | 107.45 | 134.56 | 97.83 | 124.07 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 116.12 | 254.24 | 319.79 | 254.24 | 319.79 | 254.24 | 319.79 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 23.22 | 50.85 | 63.96 | 50.85 | 63.96 | 50.85 | 63.96 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 1163.70 | 2882.70 | 2608.59 | 3244.58 | 2982.69 | 3534.04 | 3324.79 |
| CMLP Irrig. Intensity Dependability 90% | % | 67.17 | 91.88 | 77.16 | 87.22 | 73.37 | 83.61 | 70.43 |
| Dependability 75% | % | 98.99 | 172.27 | 145.41 | 165.78 | 139.83 | 160.06 | 135.08 |
| Dependability 50% | % | 99.41 | 172.83 | 145.88 | 166.34 | 140.30 | 160.63 | 135.54 |
| Dependability 25% | % | 99.59 | 173.09 | 146.11 | 166.60 | 140.51 | 160.87 | 135.75 |
| Weighted Mean | % | 94.55 | 160.66 | 135.55 | 154.44 | 130.23 | 149.04 | 125.75 |
| CMLP GW Use Dependability 90% | % | 41.28 | 40.31 | 47.27 | 37.71 | 44.90 | 35.53 | 42.90 |
| Dependability 75% | % | 23.98 | 34.23 | 41.86 | 32.84 | 40.52 | 31.73 | 39.42 |
| Dependability 50% | % | 21.01 | 29.58 | 37.68 | 28.19 | 36.22 | 27.16 | 35.04 |
| Dependability 25% | % | 19.16 | 26.51 | 34.88 | 25.13 | 33.36 | 24.17 | 32.11 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 122.58 | 69.46 | 122.58 | 69.46 | 122.58 | 69.46 |
| Annuity Total Project Cost | Mill.Rs./yr | 49.93 | 214.33 | 186.53 | 208.15 | 179.62 | 203.16 | 174.01 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 122.58 | 69.46 | 122.58 | 69.46 | 122.58 | 69.46 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 49.93 | 214.33 | 186.53 | 208.15 | 179.62 | 203.16 | 174.01 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 1163.70 | 2882.70 | 2608.59 | 3244.58 | 2982.69 | 3534.04 | 3324.79 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 229.42 | 376.88 | 312.90 | 363.33 | 300.61 | 351.85 | 290.29 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 424.01 | 524.44 | 552.01 | 506.10 | 532.25 | 490.54 | 515.52 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 6.16 | 6.16 | 6.16 | 6.16 | 6.16 | 6.16 | 6.16 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 3247.59 | 3415.60 | -168.01 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 3209.54 | 3377.55 | -168.01 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 38.06 | 38.06 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 18385.09 | 16719.76 | 1665.32 |
| 5. Total Project Costs | Mill.Rs. | | 1313.88 | 1140.98 | 172.90 |
| 6. Project Capital Costs | Mill.Rs. | | 757.11 | 429.04 | 328.07 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 1313.88 | 1140.98 | 172.90 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 757.11 | 429.04 | 328.07 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 17071.20 | 15578.78 | 1492.42 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.40 | 0.33 | |
| 2. Priority Sectors Use | % | | 1.17 | 1.11 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 9464 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.14 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **2.97** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Mataji Ka Khera Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | Nandsamand |
| District | Chittor,Rajsamand,Udaipur | Name(s): | |
| Groundwater Potential Zone (PZ) | Bhopalsagar,Railmagra,Mavli | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 14.2 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 11.0168 | Code: | |
| Present Dead Storage, $Mm^3$ | 0.78647 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.17 | 0.33 | 0.33 | 0.42 | 0.42 | 0.43 | 0.43 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.14 | 0.15 | 0.15 | 0.17 | 0.17 | 0.18 | 0.18 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,057 | 3,057 | 3,057 | 3,057 | 3,057 | 3,057 | 3,057 |
| 2005 Irrigation (Gross) | | $Mm^3/yr$ | 5.69 | | | | | | |
| 2005Irrigated Area | | ha | 200 | | | | | | |

### III. Water Sources

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| | Dependability 50% | $Mm^3/yr$ | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| | Dependability 25% | $Mm^3/yr$ | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| | Weighted Mean | $Mm^3/yr$ | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 |
| Losses from Reservoir | Annual | % | 19.32 | | | | | | |
| | During the Rabi Season | % | 9.29 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.00 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.02 | 0.02 | 0.06 | 0.06 | 0.09 | 0.09 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 11.02 | 11.01 | 11.01 | 10.99 | 10.99 | 10.97 | 10.97 |
| Import: | Mean | $Mm^3/yr$ | 4.44 | 0.00 | 4.44 | 0.00 | 4.44 | 0.00 | 4.44 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 |
| | Dependability 25% | $Mm^3/yr$ | 10.59 | 10.59 | 10.59 | 10.59 | 10.59 | 10.59 | 10.59 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 4.97 | 4.97 | 4.97 | 4.96 | 4.96 | 4.95 | 4.95 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 |
| Dependability 50% | $Mm^3/yr$ | 3.61 | 3.61 | 3.61 | 3.61 | 3.61 | 3.61 | 3.61 |
| Dependability 25% | $Mm^3/yr$ | 9.99 | 9.98 | 9.98 | 9.97 | 9.97 | 9.95 | 9.95 |
| On-Farm Irrigation Efficiency | % | 56.02 | 70.00 | 56.02 | 70.00 | 56.02 | 70.00 | 56.02 |
| Off-Farm Irrigation Efficiency | % | 13.30 | 72.00 | 13.30 | 72.00 | 13.30 | 72.00 | 13.30 |
| Present Overall Irrigation Efficiency | % | 7.45 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 0.66 | 3.58 | 0.66 | 3.57 | 0.66 | 3.57 | 0.66 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.13 | 0.02 | 0.13 | 0.02 | 0.13 | 0.02 |
| Dependability 50% | $Mm^3/yr$ | 0.48 | 2.60 | 0.48 | 2.60 | 0.48 | 2.60 | 0.48 |
| Dependability 25% | $Mm^3/yr$ | 1.33 | 7.19 | 1.33 | 7.18 | 1.33 | 7.16 | 1.32 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 22 | 117 | 22 | 117 | 22 | 117 | 22 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 1 | 4 | 1 | 4 | 1 | 4 | 1 |
| Dependability 50% | mm/yr | 16 | 85 | 16 | 85 | 16 | 85 | 16 |
| Dependability 25% | mm/yr | 43 | 235 | 43 | 235 | 43 | 234 | 43 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.50 | 2.50 | 2.50 | 2.49 | 2.49 | 2.49 | 2.49 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.16 | 0.17 | 0.17 | 0.18 | 0.18 | 0.19 | 0.19 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.37 | 0.38 | 0.38 | 0.40 | 0.40 | 0.42 | 0.42 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 64.79 | | 64.79 | | 64.79 | | 64.79 |
| Weighted Mean | $Mm^3/yr$ | 3.22 | 1.79 | 3.22 | 1.79 | 3.22 | 1.78 | 3.21 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.12 | 0.07 | 0.12 | 0.07 | 0.12 | 0.07 | 0.12 |
| Dependability 50% | $Mm^3/yr$ | 2.34 | 1.30 | 2.34 | 1.30 | 2.34 | 1.30 | 2.34 |
| Dependability 25% | $Mm^3/yr$ | 6.47 | 3.59 | 6.47 | 3.59 | 6.46 | 3.58 | 6.44 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.11 | 0.04 | 0.05 | 0.01 | 0.02 | 0.01 | 0.02 |
| Dependability 90% | $Mm^3/yr$ | 0.11 | 0.04 | 0.05 | 0.01 | 0.02 | 0.01 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 0.11 | 0.04 | 0.05 | 0.01 | 0.02 | 0.01 | 0.02 |
| Dependability 50% | $Mm^3/yr$ | 0.11 | 0.04 | 0.05 | 0.01 | 0.02 | 0.01 | 0.02 |
| Dependability 25% | $Mm^3/yr$ | 0.11 | 0.04 | 0.05 | 0.01 | 0.02 | 0.01 | 0.02 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 3.33 | 1.83 | 3.27 | 1.80 | 3.24 | 1.79 | 3.22 |
| Dependability 90% | $Mm^3/yr$ | 0.11 | 0.04 | 0.05 | 0.01 | 0.02 | 0.01 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 0.22 | 0.10 | 0.17 | 0.08 | 0.14 | 0.08 | 0.13 |
| Dependability 50% | $Mm^3/yr$ | 2.44 | 1.34 | 2.39 | 1.31 | 2.36 | 1.31 | 2.35 |
| Dependability 25% | $Mm^3/yr$ | 6.58 | 3.63 | 6.52 | 3.60 | 6.48 | 3.59 | 6.46 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 90% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 50% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 25% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 3.36 | 1.87 | 3.32 | 1.85 | 3.29 | 1.85 | 3.28 |
| Dependability 90% | $Mm^3/yr$ | 0.13 | 0.08 | 0.10 | 0.07 | 0.07 | 0.07 | 0.07 |
| Dependability 75% | $Mm^3/yr$ | 0.25 | 0.14 | 0.22 | 0.13 | 0.19 | 0.13 | 0.19 |
| Dependability 50% | $Mm^3/yr$ | 2.47 | 1.38 | 2.44 | 1.37 | 2.41 | 1.37 | 2.41 |
| Dependability 25% | $Mm^3/yr$ | 6.61 | 3.67 | 6.57 | 3.66 | 6.53 | 3.65 | 6.51 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 3.71 | 2.05 | 3.50 | 1.92 | 3.36 | 1.90 | 3.33 |
| Dependability 90% | $Mm^3/yr$ | 0.48 | 0.26 | 0.28 | 0.14 | 0.14 | 0.12 | 0.12 |
| Dependability 75% | $Mm^3/yr$ | 0.60 | 0.32 | 0.40 | 0.20 | 0.26 | 0.18 | 0.24 |
| Dependability 50% | $Mm^3/yr$ | 2.82 | 1.56 | 2.62 | 1.44 | 2.48 | 1.42 | 2.46 |
| Dependability 25% | $Mm^3/yr$ | 6.96 | 3.85 | 6.75 | 3.73 | 6.60 | 3.70 | 6.56 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 3.04 | 2.39 | 2.98 | 2.16 | 2.79 | 2.11 | 2.76 |
| Dependability 90% | $Mm^3/yr$ | 0.48 | 0.26 | 0.28 | 0.14 | 0.14 | 0.12 | 0.12 |
| Dependability 75% | $Mm^3/yr$ | 0.60 | 0.32 | 0.40 | 0.20 | 0.26 | 0.18 | 0.24 |
| Dependability 50% | $Mm^3/yr$ | 2.82 | 1.56 | 2.62 | 1.44 | 2.48 | 1.42 | 2.46 |
| Dependability 25% | $Mm^3/yr$ | 4.02 | 3.85 | 4.55 | 3.73 | 4.55 | 3.70 | 4.55 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 99 | 78 | 97 | 71 | 91 | 69 | 90 |
| | Dependability 90% | mm/yr | 16 | 8 | 9 | 5 | 5 | 4 | 4 |
| | Dependability 75% | mm/yr | 20 | 11 | 13 | 7 | 9 | 6 | 8 |
| | Dependability 50% | mm/yr | 92 | 51 | 86 | 47 | 81 | 46 | 80 |
| | Dependability 25% | mm/yr | 131 | 126 | 149 | 122 | 149 | 121 | 149 |
| Well Yield | | $10^3 m^3/yr$ | 13 | | | | | | |
| No. of Irrigation Wells | Existing | | 313 | 313 | 313 | 313 | 354 | 313 | 354 |
| | Additional | | | 0 | 41 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 4.02 | 4.02 | 4.55 | 4.02 | 4.55 | 4.02 | 4.55 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 0.80 | 0.80 | 0.91 | 0.80 | 0.91 | 0.80 | 0.91 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 3.70 | 5.97 | 3.64 | 5.73 | 3.45 | 5.68 | 3.41 |
| | Dependability 90% | $Mm^3/yr$ | 0.48 | 0.26 | 0.28 | 0.14 | 0.14 | 0.12 | 0.12 |
| | Dependability 75% | $Mm^3/yr$ | 0.63 | 0.46 | 0.42 | 0.33 | 0.29 | 0.31 | 0.26 |
| | Dependability 50% | $Mm^3/yr$ | 3.30 | 4.16 | 3.10 | 4.04 | 2.96 | 4.01 | 2.94 |
| | Dependability 25% | $Mm^3/yr$ | 5.35 | 11.04 | 5.88 | 10.90 | 5.87 | 10.86 | 5.87 |
| Depth | ted Mean | mm/yr | 121 | 195 | 119 | 187 | 113 | 186 | 112 |
| | Dependability 90% | mm/yr | 16 | 8 | 9 | 5 | 5 | 4 | 4 |
| | Dependability 75% | mm/yr | 20 | 15 | 14 | 11 | 9 | 10 | 9 |
| | Dependability 50% | mm/yr | 108 | 136 | 101 | 132 | 97 | 131 | 96 |
| | Dependability 25% | mm/yr | 175 | 361 | 192 | 357 | 192 | 355 | 192 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11285 | | | | | | |
| | Total | Mill.Rs. | | 34.50 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 34.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.54 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.64 | 1.29 | 1.61 | 1.17 | 1.51 | 1.14 | 1.49 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.64 | 1.29 | 1.61 | 1.17 | 1.51 | 1.14 | 1.49 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 1.64 | 1.29 | 1.61 | 1.17 | 1.51 | 1.14 | 1.49 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.210 | 0.200 | 0.150 | 0.440 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Mataji Ka Khera Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Chittor,Rajsamand,Udaipur |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.21 | 0.2 | 0.15 | 0.44 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3057 | 3057 | 3057 | 3057 | 3057 | 3057 | 3057 |
| SW On-Farm Irrigation Efficiency | % | 56.02 | 70.00 | 56.02 | 70.00 | 56.02 | 70.00 | 56.02 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.13 | 0.02 | 0.13 | 0.02 | 0.13 | 0.02 |
| Dependability 50% | $Mm^3/yr$ | 0.48 | 2.60 | 0.48 | 2.60 | 0.48 | 2.60 | 0.48 |
| Dependability 25% | $Mm^3/yr$ | 1.33 | 7.19 | 1.33 | 7.18 | 1.33 | 7.16 | 1.32 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.48 | 0.26 | 0.28 | 0.14 | 0.14 | 0.12 | 0.12 |
| Dependability 75% | $Mm^3/yr$ | 0.60 | 0.32 | 0.40 | 0.20 | 0.26 | 0.18 | 0.24 |
| Dependability 50% | $Mm^3/yr$ | 2.82 | 1.56 | 2.62 | 1.44 | 2.48 | 1.42 | 2.46 |
| Dependability 25% | $Mm^3/yr$ | 6.96 | 3.85 | 6.75 | 3.73 | 6.60 | 3.70 | 6.56 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.48 | 0.26 | 0.28 | 0.14 | 0.14 | 0.12 | 0.12 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 4.02 | 4.02 | 4.55 | 4.02 | 4.55 | 4.02 | 4.55 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 0.80 | 0.80 | 0.91 | 0.80 | 0.91 | 0.80 | 0.91 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 14.54 | 27.31 | 13.61 | 31.61 | 15.74 | 36.17 | 18.03 |
| CMLP Irrig. Intensity Dependability 90% | % | 2.66 | 1.69 | 1.57 | 0.90 | 0.82 | 0.76 | 0.68 |
| Dependability 75% | % | 3.44 | 2.94 | 2.37 | 2.16 | 1.63 | 2.02 | 1.49 |
| Dependability 50% | % | 18.20 | 26.62 | 17.53 | 26.05 | 16.93 | 25.90 | 16.79 |
| Dependability 25% | % | 28.69 | 71.48 | 33.02 | 70.47 | 33.31 | 70.19 | 33.29 |
| Weighted Mean | % | 16.60 | 36.39 | 17.96 | 35.54 | 17.69 | 35.33 | 17.61 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 95.83 | 70.01 | 93.84 | 59.42 | 91.15 | 56.54 | 90.83 |
| Dependability 50% | % | 85.07 | 29.96 | 84.01 | 30.28 | 83.40 | 29.90 | 83.26 |
| Dependability 25% | % | 71.76 | 25.60 | 75.30 | 25.46 | 76.02 | 26.79 | 76.06 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.81 | 0.00 | 3.81 | 0.00 | 3.81 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 1.64 | 5.10 | 1.61 | 4.97 | 1.51 | 4.95 | 1.49 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 3.81 | 0.00 | 3.81 | 0.00 | 3.81 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 1.64 | 5.10 | 1.61 | 4.97 | 1.51 | 4.95 | 1.49 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 14.54 | 27.31 | 13.61 | 31.61 | 15.74 | 36.17 | 18.03 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 2.34 | 4.30 | 2.31 | 4.12 | 2.18 | 4.08 | 2.16 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 3.70 | 5.97 | 3.64 | 5.73 | 3.45 | 5.68 | 3.41 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 36.50 | 22.19 | 14.30 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 36.50 | 22.19 | 14.30 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 175.77 | 87.58 | 88.20 |
| 5. Total Project Costs | Mill.Rs. | | 31.29 | 9.78 | 21.51 |
| 6. Project Capital Costs | Mill.Rs. | | 23.51 | 0.00 | 23.51 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 31.29 | 9.78 | 21.51 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 23.51 | 0.00 | 23.51 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 144.49 | 77.80 | 66.69 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.86 | 0.44 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7691 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 3.13 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **3.84** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Meja Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Bhilwara | Name(s): | Matrikundia |
| Groundwater Potential Zone (PZ) | Mandal,Suwana | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 1049 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 76.72 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.91 | 1.87 | 1.87 | 2.32 | 2.32 | 2.59 | 2.59 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.74 | 0.77 | 0.77 | 0.84 | 0.84 | 0.90 | 0.90 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 18,616 | 18,616 | 18,616 | 18,616 | 18,616 | 18,616 | 18,616 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 0.00 | | | | | | |
| 2010 Irrigated Area | | ha | 0 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 8.66 | 8.66 | 8.66 | 8.66 | 8.66 | 8.66 | 8.66 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| | Dependability 25% | $Mm^3/yr$ | 13.50 | 13.50 | 13.50 | 13.50 | 13.50 | 13.50 | 13.50 |
| | Weighted Mean | $Mm^3/yr$ | 4.67 | 4.67 | 4.67 | 4.67 | 4.67 | 4.67 | 4.67 |
| Losses from Reservoir | Annual | % | 14.87 | | | | | | |
| | During the Rabi Season | % | 7.15 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.14 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 1.37 | 1.37 | 4.12 | 4.12 | 6.87 | 6.87 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 76.72 | 75.35 | 75.35 | 72.60 | 72.60 | 69.85 | 69.85 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| | Dependability 50% | $Mm^3/yr$ | 19.81 | 19.81 | 19.81 | 19.81 | 19.81 | 19.81 | 19.81 |
| | Dependability 25% | $Mm^3/yr$ | 32.83 | 32.83 | 32.83 | 32.83 | 32.83 | 32.83 | 32.83 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 15.86 | 15.86 | 15.86 | 15.86 | 15.86 | 15.86 | 15.86 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 16.36 | 16.36 | 16.36 | 16.36 | 16.36 | 16.36 | 16.36 |
| Dependability 25% | $Mm^3/yr$ | 39.04 | 39.04 | 39.04 | 39.04 | 39.04 | 39.04 | 39.04 |
| On-Farm Irrigation Efficiency | % | 57.10 | 70.00 | 57.10 | 70.00 | 57.10 | 70.00 | 57.10 |
| Off-Farm Irrigation Efficiency | % | 27.41 | 72.00 | 27.41 | 72.00 | 27.41 | 72.00 | 27.41 |
| Present Overall Irrigation Efficiency | % | 15.65 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 4.35 | 11.42 | 4.35 | 11.42 | 4.35 | 11.42 | 4.35 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 4.48 | 11.78 | 4.48 | 11.78 | 4.48 | 11.78 | 4.48 |
| Dependability 25% | $Mm^3/yr$ | 10.70 | 28.11 | 10.70 | 28.11 | 10.70 | 28.11 | 10.70 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 23 | 61 | 23 | 61 | 23 | 61 | 23 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 50% | mm/yr | 24 | 63 | 24 | 63 | 24 | 63 | 24 |
| Dependability 25% | mm/yr | 57 | 151 | 57 | 151 | 57 | 151 | 57 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 9.76 | 9.76 | 9.76 | 9.76 | 9.76 | 9.76 | 9.76 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 |
| Dependability 50% | $Mm^3/yr$ | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 |
| Dependability 25% | $Mm^3/yr$ | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 | 3.65 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 6.05 | 6.05 | 6.05 | 6.05 | 6.05 | 6.05 | 6.05 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 59.05 | | 59.05 | | 59.05 | | 59.05 |
| Weighted Mean | $Mm^3/yr$ | 9.37 | 5.71 | 9.37 | 5.71 | 9.37 | 5.71 | 9.37 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 9.66 | 5.89 | 9.66 | 5.89 | 9.66 | 5.89 | 9.66 |
| Dependability 25% | $Mm^3/yr$ | 23.05 | 14.05 | 23.05 | 14.05 | 23.05 | 14.05 | 23.05 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 1.32 | 0.68 | 1.02 | 0.58 | 0.87 | 0.51 | 0.77 |
| Dependability 90% | $Mm^3/yr$ | 1.32 | 0.68 | 1.02 | 0.58 | 0.87 | 0.51 | 0.77 |
| Dependability 75% | $Mm^3/yr$ | 1.32 | 0.68 | 1.02 | 0.58 | 0.87 | 0.51 | 0.77 |
| Dependability 50% | $Mm^3/yr$ | 1.32 | 0.68 | 1.02 | 0.58 | 0.87 | 0.51 | 0.77 |
| Dependability 25% | $Mm^3/yr$ | 1.32 | 0.68 | 1.02 | 0.58 | 0.87 | 0.51 | 0.77 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 10.69 | 6.39 | 10.39 | 6.29 | 10.23 | 6.22 | 10.14 |
| Dependability 90% | $Mm^3/yr$ | 1.32 | 0.68 | 1.02 | 0.58 | 0.87 | 0.51 | 0.77 |
| Dependability 75% | $Mm^3/yr$ | 1.32 | 0.68 | 1.02 | 0.58 | 0.87 | 0.51 | 0.77 |
| Dependability 50% | $Mm^3/yr$ | 10.98 | 6.57 | 10.68 | 6.47 | 10.53 | 6.40 | 10.43 |
| Dependability 25% | $Mm^3/yr$ | 24.37 | 14.74 | 24.07 | 14.63 | 23.92 | 14.57 | 23.82 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.62 | 0.69 | 0.69 | 0.68 | 0.68 | 0.66 | 0.66 |
| Dependability 90% | $Mm^3/yr$ | 0.15 | 0.24 | 0.24 | 0.29 | 0.29 | 0.32 | 0.32 |
| Dependability 75% | $Mm^3/yr$ | 0.20 | 0.29 | 0.29 | 0.33 | 0.33 | 0.35 | 0.35 |
| Dependability 50% | $Mm^3/yr$ | 0.99 | 1.04 | 1.04 | 0.99 | 0.99 | 0.93 | 0.93 |
| Dependability 25% | $Mm^3/yr$ | 0.99 | 1.04 | 1.04 | 0.99 | 0.99 | 0.93 | 0.93 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 11.31 | 7.08 | 11.08 | 6.97 | 10.92 | 6.88 | 10.79 |
| Dependability 90% | $Mm^3/yr$ | 1.47 | 0.92 | 1.26 | 0.87 | 1.15 | 0.83 | 1.09 |
| Dependability 75% | $Mm^3/yr$ | 1.52 | 0.97 | 1.31 | 0.91 | 1.20 | 0.86 | 1.12 |
| Dependability 50% | $Mm^3/yr$ | 11.97 | 7.61 | 11.72 | 7.46 | 11.52 | 7.33 | 11.35 |
| Dependability 25% | $Mm^3/yr$ | 25.36 | 15.77 | 25.11 | 15.62 | 24.91 | 15.49 | 24.74 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 15.71 | 10.49 | 14.49 | 9.86 | 13.81 | 9.44 | 13.35 |
| Dependability 90% | $Mm^3/yr$ | 5.87 | 4.33 | 4.67 | 3.76 | 4.04 | 3.39 | 3.65 |
| Dependability 75% | $Mm^3/yr$ | 5.92 | 4.38 | 4.72 | 3.80 | 4.09 | 3.42 | 3.68 |
| Dependability 50% | $Mm^3/yr$ | 16.37 | 11.02 | 15.13 | 10.35 | 14.41 | 9.89 | 13.91 |
| Dependability 25% | $Mm^3/yr$ | 29.76 | 19.18 | 28.52 | 18.51 | 27.80 | 18.05 | 27.30 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 14.68 | 10.49 | 13.85 | 9.86 | 13.39 | 9.44 | 13.09 |
| Dependability 90% | $Mm^3/yr$ | 5.87 | 4.33 | 4.67 | 3.76 | 4.04 | 3.39 | 3.65 |
| Dependability 75% | $Mm^3/yr$ | 5.92 | 4.38 | 4.72 | 3.80 | 4.09 | 3.42 | 3.68 |
| Dependability 50% | $Mm^3/yr$ | 16.37 | 11.02 | 15.13 | 10.35 | 14.41 | 9.89 | 13.91 |
| Dependability 25% | $Mm^3/yr$ | 26.46 | 19.18 | 26.46 | 18.51 | 26.46 | 18.05 | 26.46 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 79 | 56 | 74 | 53 | 72 | 51 | 70 |
| | Dependability 90% | mm/yr | 32 | 23 | 25 | 20 | 22 | 18 | 20 |
| | Dependability 75% | mm/yr | 32 | 24 | 25 | 20 | 22 | 18 | 20 |
| | Dependability 50% | mm/yr | 88 | 59 | 81 | 56 | 77 | 53 | 75 |
| | Dependability 25% | mm/yr | 142 | 103 | 142 | 99 | 142 | 97 | 142 |
| Well Yield | | $10^3 m^3/yr$ | 10 | | | | | | |
| No. of Irrigation Wells | Existing | | 2724 | 2728 | 2724 | 2728 | 2724 | 2728 | 2724 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 26.46 | 26.50 | 26.46 | 26.50 | 26.46 | 26.50 | 26.46 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 5.29 | 5.30 | 5.29 | 5.30 | 5.29 | 5.30 | 5.29 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 19.03 | 21.91 | 18.20 | 21.28 | 17.74 | 20.86 | 17.44 |
| | Dependability 90% | $Mm^3/yr$ | 5.87 | 4.33 | 4.67 | 3.76 | 4.04 | 3.39 | 3.65 |
| | Dependability 75% | $Mm^3/yr$ | 5.92 | 4.38 | 4.72 | 3.80 | 4.09 | 3.42 | 3.68 |
| | Dependability 50% | $Mm^3/yr$ | 20.86 | 22.80 | 19.62 | 22.13 | 18.90 | 21.67 | 18.40 |
| | Dependability 25% | $Mm^3/yr$ | 37.16 | 47.29 | 37.16 | 46.62 | 37.16 | 46.16 | 37.16 |
| Depth | ted Mean | mm/yr | 102 | 118 | 98 | 114 | 95 | 112 | 94 |
| | Dependability 90% | mm/yr | 32 | 23 | 25 | 20 | 22 | 18 | 20 |
| | Dependability 75% | mm/yr | 32 | 24 | 25 | 20 | 22 | 18 | 20 |
| | Dependability 50% | mm/yr | 112 | 122 | 105 | 119 | 102 | 116 | 99 |
| | Dependability 25% | mm/yr | 200 | 254 | 200 | 250 | 200 | 248 | 200 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.14 | 0.57 | 0.57 | 1.03 | 1.03 | 1.83 | 1.83 |
| | Annual Irrigation Depth | mm | 0.75 | 3.06 | 3.06 | 5.53 | 5.53 | 9.80 | 9.80 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9821 | | | | | | |
| | Total | Mill.Rs. | | 182.83 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 182.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.51 | | | | | | |
| Average Annual Cost | Mill.Rs | 7.49 | 5.35 | 7.06 | 5.03 | 6.83 | 4.81 | 6.68 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 7.49 | 5.35 | 7.06 | 5.03 | 6.83 | 4.81 | 6.68 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 7.49 | 5.35 | 7.06 | 5.03 | 6.83 | 4.81 | 6.68 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.150 | 0.310 | 0.230 | 0.310 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Meja Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Bhilwara |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.15 | 0.31 | 0.23 | 0.31 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 18616 | 18616 | 18616 | 18616 | 18616 | 18616 | 18616 |
| SW On-Farm Irrigation Efficiency | % | 57.10 | 70.00 | 57.10 | 70.00 | 57.10 | 70.00 | 57.10 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 4.48 | 11.78 | 4.48 | 11.78 | 4.48 | 11.78 | 4.48 |
| Dependability 25% | $Mm^3/yr$ | 10.70 | 28.11 | 10.70 | 28.11 | 10.70 | 28.11 | 10.70 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 5.87 | 4.33 | 4.67 | 3.76 | 4.04 | 3.39 | 3.65 |
| Dependability 75% | $Mm^3/yr$ | 5.92 | 4.38 | 4.72 | 3.80 | 4.09 | 3.42 | 3.68 |
| Dependability 50% | $Mm^3/yr$ | 16.37 | 11.02 | 15.13 | 10.35 | 14.41 | 9.89 | 13.91 |
| Dependability 25% | $Mm^3/yr$ | 29.76 | 19.18 | 28.52 | 18.51 | 27.80 | 18.05 | 27.30 |
| Firm GW for Kharif | $Mm^3/yr$ | 5.87 | 4.33 | 4.67 | 3.76 | 4.04 | 3.39 | 3.65 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 26.46 | 26.50 | 26.46 | 26.50 | 26.46 | 26.50 | 26.46 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 5.29 | 5.30 | 5.29 | 5.30 | 5.29 | 5.30 | 5.29 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 88.68 | 110.72 | 80.13 | 129.60 | 94.17 | 150.34 | 109.60 |
| CMLP Irrig. Intensity Dependability 90% | % | 5.30 | 4.85 | 4.53 | 4.08 | 3.80 | 3.68 | 3.43 |
| Dependability 75% | % | 5.36 | 4.91 | 4.59 | 4.13 | 3.85 | 3.73 | 3.47 |
| Dependability 50% | % | 18.45 | 24.81 | 18.63 | 23.34 | 17.39 | 22.83 | 16.91 |
| Dependability 25% | % | 32.63 | 51.33 | 35.12 | 49.04 | 34.06 | 48.53 | 34.06 |
| Weighted Mean | % | 16.82 | 23.87 | 17.27 | 22.46 | 16.32 | 22.00 | 16.04 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 50% | % | 77.24 | 45.00 | 76.25 | 44.69 | 75.69 | 43.49 | 75.01 |
| Dependability 25% | % | 68.11 | 35.26 | 68.02 | 36.54 | 69.33 | 35.89 | 69.33 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 20.17 | 0.00 | 20.17 | 0.00 | 20.17 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 7.49 | 25.52 | 7.06 | 25.20 | 6.83 | 24.99 | 6.68 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 20.17 | 0.00 | 20.17 | 0.00 | 20.17 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 7.49 | 25.52 | 7.06 | 25.20 | 6.83 | 24.99 | 6.68 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 88.68 | 110.72 | 80.13 | 129.60 | 94.17 | 150.34 | 109.60 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 12.03 | 15.86 | 11.48 | 15.39 | 11.19 | 15.08 | 10.99 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 19.03 | 21.91 | 18.20 | 21.28 | 17.74 | 20.86 | 17.44 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 146.92 | 124.25 | 22.68 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 134.34 | 111.66 | 22.68 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 12.58 | 12.58 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 715.19 | 518.24 | 196.94 |
| 5. Total Project Costs | Mill.Rs. | | 157.13 | 43.25 | 113.88 |
| 6. Project Capital Costs | Mill.Rs. | | 124.60 | 0.00 | 124.60 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 157.13 | 43.25 | 113.88 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 124.60 | 0.00 | 124.60 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 558.06 | 474.99 | 83.06 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.07 | 0.35 | |
| 2. Priority Sectors Use | % | | 8.56 | 10.13 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6693 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.53 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **1.67** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Murlia Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Chittor | Name(s): | |
| Groundwater Potential Zone (PZ) | Chittor,Nimbahera | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 111.4 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 8.19 | Code: | |
| Present Dead Storage, $Mm^3$ | 0.8 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.05 | 0.10 | 0.10 | 0.12 | 0.12 | 0.13 | 0.13 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 1,323 | 1,323 | 1,323 | 1,323 | 1,323 | 1,323 | 1,323 |
| 2006Irrigation (Gross) | | $Mm^3/yr$ | 8.97 | | | | | | |
| 2006 Irrigated Area | | ha | 897 | | | | | | |

### III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 21.16 | 21.16 | 21.16 | 21.16 | 21.16 | 21.16 | 21.16 |
| Dependability 90% | $Mm^3/yr$ | 3.40 | 3.40 | 3.40 | 3.40 | 3.40 | 3.40 | 3.40 |
| Dependability 75% | $Mm^3/yr$ | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 |
| Dependability 50% | $Mm^3/yr$ | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 | 15.60 |
| Dependability 25% | $Mm^3/yr$ | 23.60 | 23.60 | 23.60 | 23.60 | 23.60 | 23.60 | 23.60 |
| Weighted Mean | $Mm^3/yr$ | 14.85 | 14.85 | 14.85 | 14.85 | 14.85 | 14.85 | 14.85 |
| Losses from Reservoir Annual | % | 14.93 | | | | | | |
| During the Rabi Season | % | 7.18 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.01 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.15 | 0.15 | 0.44 | 0.44 | 0.73 | 0.73 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 8.19 | 8.11 | 8.11 | 7.95 | 7.95 | 7.79 | 7.79 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 6.67 | 6.61 | 6.61 | 6.49 | 6.49 | 6.37 | 6.37 |
| Dependability 90% | $Mm^3/yr$ | 3.16 | 3.16 | 3.16 | 3.16 | 3.16 | 3.16 | 3.16 |
| Dependability 75% | $Mm^3/yr$ | 7.60 | 7.53 | 7.53 | 7.38 | 7.38 | 7.23 | 7.23 |
| Dependability 50% | $Mm^3/yr$ | 7.60 | 7.53 | 7.53 | 7.38 | 7.38 | 7.23 | 7.23 |
| Dependability 25% | $Mm^3/yr$ | 7.60 | 7.53 | 7.53 | 7.38 | 7.38 | 7.23 | 7.23 |
| On-Farm Irrigation Efficiency | % | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 |
| Off-Farm Irrigation Efficiency | % | 35.63 | 72.00 | 35.63 | 72.00 | 35.63 | 72.00 | 35.63 |
| Present Overall Irrigation Efficiency | % | 20.31 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 2.38 | 4.76 | 2.35 | 4.67 | 2.31 | 4.59 | 2.27 |
| Dependability 90% | $Mm^3/yr$ | 1.12 | 2.27 | 1.12 | 2.27 | 1.12 | 2.27 | 1.12 |
| Dependability 75% | $Mm^3/yr$ | 2.71 | 5.42 | 2.68 | 5.31 | 2.63 | 5.21 | 2.58 |
| Dependability 50% | $Mm^3/yr$ | 2.71 | 5.42 | 2.68 | 5.31 | 2.63 | 5.21 | 2.58 |
| Dependability 25% | $Mm^3/yr$ | 2.71 | 5.42 | 2.68 | 5.31 | 2.63 | 5.21 | 2.58 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 180 | 360 | 178 | 353 | 175 | 347 | 172 |
| Dependability 90% | mm/yr | 85 | 172 | 85 | 172 | 85 | 172 | 85 |
| Dependability 75% | mm/yr | 205 | 410 | 203 | 402 | 199 | 393 | 195 |
| Dependability 50% | mm/yr | 205 | 410 | 203 | 402 | 199 | 393 | 195 |
| Dependability 25% | mm/yr | 205 | 410 | 203 | 402 | 199 | 393 | 195 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 1.90 | 1.88 | 1.88 | 1.84 | 1.84 | 1.81 | 1.81 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 7.66 | 7.73 | 7.73 | 7.85 | 7.85 | 7.98 | 7.98 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 1.11 | 1.19 | 1.19 | 1.35 | 1.35 | 1.51 | 1.51 |
| Dependability 50% | $Mm^3/yr$ | 7.41 | 7.49 | 7.49 | 7.65 | 7.65 | 7.81 | 7.81 |
| Dependability 25% | $Mm^3/yr$ | 15.41 | 15.49 | 15.49 | 15.65 | 15.65 | 15.81 | 15.81 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 55.78 | | 55.78 | | 55.78 | | 55.78 |
| Weighted Mean | $Mm^3/yr$ | 3.72 | 2.38 | 3.69 | 2.34 | 3.62 | 2.29 | 3.56 |
| Dependability 90% | $Mm^3/yr$ | 1.76 | 1.14 | 1.76 | 1.14 | 1.76 | 1.14 | 1.76 |
| Dependability 75% | $Mm^3/yr$ | 4.24 | 2.71 | 4.20 | 2.66 | 4.12 | 2.60 | 4.03 |
| Dependability 50% | $Mm^3/yr$ | 4.24 | 2.71 | 4.20 | 2.66 | 4.12 | 2.60 | 4.03 |
| Dependability 25% | $Mm^3/yr$ | 4.24 | 2.71 | 4.20 | 2.66 | 4.12 | 2.60 | 4.03 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.15 | 0.09 | 0.13 | 0.08 | 0.12 | 0.08 | 0.12 |
| Dependability 90% | $Mm^3/yr$ | 0.15 | 0.09 | 0.13 | 0.08 | 0.12 | 0.08 | 0.12 |
| Dependability 75% | $Mm^3/yr$ | 0.15 | 0.09 | 0.13 | 0.08 | 0.12 | 0.08 | 0.12 |
| Dependability 50% | $Mm^3/yr$ | 0.15 | 0.09 | 0.13 | 0.08 | 0.12 | 0.08 | 0.12 |
| Dependability 25% | $Mm^3/yr$ | 0.15 | 0.09 | 0.13 | 0.08 | 0.12 | 0.08 | 0.12 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 3.87 | 2.46 | 3.81 | 2.42 | 3.74 | 2.37 | 3.67 |
| Dependability 90% | $Mm^3/yr$ | 1.91 | 1.22 | 1.89 | 1.22 | 1.88 | 1.21 | 1.88 |
| Dependability 75% | $Mm^3/yr$ | 4.39 | 2.80 | 4.33 | 2.74 | 4.24 | 2.68 | 4.15 |
| Dependability 50% | $Mm^3/yr$ | 4.39 | 2.80 | 4.33 | 2.74 | 4.24 | 2.68 | 4.15 |
| Dependability 25% | $Mm^3/yr$ | 4.39 | 2.80 | 4.33 | 2.74 | 4.24 | 2.68 | 4.15 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 |
| Dependability 90% | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 |
| Dependability 75% | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 |
| Dependability 50% | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 |
| Dependability 25% | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 3.87 | 2.48 | 3.83 | 2.43 | 3.76 | 2.39 | 3.69 |
| Dependability 90% | $Mm^3/yr$ | 1.92 | 1.24 | 1.90 | 1.23 | 1.90 | 1.23 | 1.90 |
| Dependability 75% | $Mm^3/yr$ | 4.40 | 2.81 | 4.34 | 2.75 | 4.25 | 2.70 | 4.17 |
| Dependability 50% | $Mm^3/yr$ | 4.40 | 2.81 | 4.34 | 2.75 | 4.25 | 2.70 | 4.17 |
| Dependability 25% | $Mm^3/yr$ | 4.40 | 2.81 | 4.34 | 2.75 | 4.25 | 2.70 | 4.17 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 4.36 | 2.90 | 4.25 | 2.84 | 4.16 | 2.78 | 4.08 |
| Dependability 90% | $Mm^3/yr$ | 2.41 | 1.66 | 2.33 | 1.64 | 2.30 | 1.62 | 2.29 |
| Dependability 75% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Dependability 50% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Dependability 25% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 4.36 | 2.90 | 4.25 | 2.84 | 4.16 | 2.78 | 4.08 |
| Dependability 90% | $Mm^3/yr$ | 2.41 | 1.66 | 2.33 | 1.64 | 2.30 | 1.62 | 2.29 |
| Dependability 75% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Dependability 50% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Dependability 25% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 330 | 220 | 322 | 214 | 315 | 210 | 309 |
| | Dependability 90% | mm/yr | 182 | 126 | 176 | 124 | 174 | 123 | 173 |
| | Dependability 75% | mm/yr | 369 | 244 | 360 | 239 | 352 | 234 | 345 |
| | Dependability 50% | mm/yr | 369 | 244 | 360 | 239 | 352 | 234 | 345 |
| | Dependability 25% | mm/yr | 369 | 244 | 360 | 239 | 352 | 234 | 345 |
| Well Yield | | $10^3 m^3/yr$ | 27 | | | | | | |
| No. of Irrigation Wells | Existing | | 289 | 289 | 289 | 289 | 289 | 289 | 289 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 7.77 | 7.77 | 7.77 | 7.77 | 7.77 | 7.77 | 7.77 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 6.74 | 7.66 | 6.61 | 7.51 | 6.47 | 7.37 | 6.35 |
| | Dependability 90% | $Mm^3/yr$ | 3.53 | 3.93 | 3.45 | 3.91 | 3.42 | 3.90 | 3.41 |
| | Dependability 75% | $Mm^3/yr$ | 7.59 | 8.65 | 7.45 | 8.47 | 7.28 | 8.30 | 7.14 |
| | Dependability 50% | $Mm^3/yr$ | 7.59 | 8.65 | 7.45 | 8.47 | 7.28 | 8.30 | 7.14 |
| | Dependability 25% | $Mm^3/yr$ | 7.59 | 8.65 | 7.45 | 8.47 | 7.28 | 8.30 | 7.14 |
| Depth | ted Mean | mm/yr | 510 | 579 | 500 | 568 | 489 | 557 | 480 |
| | Dependability 90% | mm/yr | 267 | 297 | 261 | 295 | 259 | 295 | 258 |
| | Dependability 75% | mm/yr | 574 | 654 | 563 | 640 | 551 | 627 | 539 |
| | Dependability 50% | mm/yr | 574 | 654 | 563 | 640 | 551 | 627 | 539 |
| | Dependability 25% | mm/yr | 574 | 654 | 563 | 640 | 551 | 627 | 539 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 10486 | | | | | | |
| | Total | Mill.Rs. | | 13.87 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 13.87 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.47 | | | | | | |
| Average Annual Cost | Mill.Rs | 2.05 | 1.36 | 2.00 | 1.33 | 1.96 | 1.31 | 1.92 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 2.05 | 1.36 | 2.00 | 1.33 | 1.96 | 1.31 | 1.92 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 2.05 | 1.36 | 2.00 | 1.33 | 1.96 | 1.31 | 1.92 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.210 | 0.170 | 0.260 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Murlia Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Chittor |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.21 | 0.17 | 0.26 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 1323 | 1323 | 1323 | 1323 | 1323 | 1323 | 1323 |
| SW On-Farm Irrigation Efficiency | % | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 | 70.00 | 57.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 1.12 | 2.27 | 1.12 | 2.27 | 1.12 | 2.27 | 1.12 |
| Dependability 75% | $Mm^3/yr$ | 2.71 | 5.42 | 2.68 | 5.31 | 2.63 | 5.21 | 2.58 |
| Dependability 50% | $Mm^3/yr$ | 2.71 | 5.42 | 2.68 | 5.31 | 2.63 | 5.21 | 2.58 |
| Dependability 25% | $Mm^3/yr$ | 2.71 | 5.42 | 2.68 | 5.31 | 2.63 | 5.21 | 2.58 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.41 | 1.66 | 2.33 | 1.64 | 2.30 | 1.62 | 2.29 |
| Dependability 75% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Dependability 50% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Dependability 25% | $Mm^3/yr$ | 4.89 | 3.23 | 4.77 | 3.16 | 4.66 | 3.09 | 4.56 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.41 | 1.66 | 2.33 | 1.64 | 2.30 | 1.62 | 2.29 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 7.77 | 7.77 | 7.77 | 7.77 | 7.77 | 7.77 | 7.77 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 | 1.55 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 26.83 | 34.59 | 27.14 | 40.55 | 31.22 | 45.01 | 34.19 |
| CMLP Irrig. Intensity Dependability 90% | % | 50.73 | 66.08 | 50.18 | 65.18 | 49.42 | 64.99 | 49.24 |
| Dependability 75% | % | 108.85 | 136.99 | 108.07 | 136.99 | 104.93 | 136.99 | 102.80 |
| Dependability 50% | % | 109.34 | 136.99 | 108.57 | 136.99 | 105.42 | 136.99 | 103.27 |
| Dependability 25% | % | 109.69 | 136.99 | 108.93 | 136.99 | 105.76 | 136.99 | 103.61 |
| Weighted Mean | % | 97.07 | 122.10 | 96.35 | 121.91 | 93.70 | 121.87 | 91.96 |
| CMLP GW Use Dependability 90% | % | 68.15 | 42.23 | 67.42 | 41.86 | 67.17 | 41.69 | 67.05 |
| Dependability 75% | % | 63.45 | 37.33 | 63.17 | 36.31 | 63.10 | 35.48 | 63.09 |
| Dependability 50% | % | 61.68 | 33.83 | 60.29 | 32.73 | 61.45 | 31.84 | 61.44 |
| Dependability 25% | % | 61.16 | 32.89 | 61.08 | 31.77 | 61.01 | 30.85 | 61.01 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 1.53 | 0.00 | 1.53 | 0.00 | 1.53 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 2.05 | 2.90 | 2.00 | 2.86 | 1.96 | 2.84 | 1.92 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 1.53 | 0.00 | 1.53 | 0.00 | 1.53 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 2.05 | 2.90 | 2.00 | 2.86 | 1.96 | 2.84 | 1.92 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 26.83 | 34.59 | 27.14 | 40.55 | 31.22 | 45.01 | 34.19 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 4.19 | 5.51 | 4.11 | 5.40 | 4.02 | 5.30 | 3.95 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 6.74 | 7.66 | 6.61 | 7.51 | 6.47 | 7.37 | 6.35 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 47.08 | 40.60 | 6.48 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 47.08 | 40.60 | 6.48 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 223.14 | 174.11 | 49.03 |
| 5. Total Project Costs | Mill.Rs. | | 17.83 | 12.28 | 5.55 |
| 6. Project Capital Costs | Mill.Rs. | | 9.45 | 0.00 | 9.45 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 17.83 | 12.28 | 5.55 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 9.45 | 0.00 | 9.45 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 205.31 | 161.83 | 43.48 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.38 | 0.30 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7146 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 3.44 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **5.60** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Narain Sagar Jalia Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Ajmer | Name(s): | |
| Groundwater Potential Zone (PZ) | Masuda | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 24 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 19.76 | Code: | |
| Present Dead Storage, $Mm^3$ | 0..06 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.17 | 0.34 | 0.34 | 0.42 | 0.42 | 0.47 | 0.47 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.13 | 0.14 | 0.14 | 0.15 | 0.15 | 0.17 | 0.17 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 4,087 | 4,087 | 4,087 | 4,087 | 4,087 | 4,087 | 4,087 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 1.74 | | | | | | |
| 2010 Irrigated Area | | ha | 327 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 4.04 | 4.04 | 4.04 | 4.04 | 4.04 | 4.04 | 4.04 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| | Dependability 50% | $Mm^3/yr$ | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| | Dependability 25% | $Mm^3/yr$ | 4.70 | 4.70 | 4.70 | 4.70 | 4.70 | 4.70 | 4.70 |
| | Weighted Mean | $Mm^3/yr$ | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 |
| Losses from Reservoir | Annual | % | 24.82 | | | | | | |
| | During the Rabi Season | % | 10.93 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.00 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.03 | 0.03 | 0.09 | 0.09 | 0.16 | 0.16 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 19.76 | 19.74 | 19.74 | 19.71 | 19.71 | 19.67 | 19.67 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| Dependability 50% | $Mm^3/yr$ | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| Dependability 25% | $Mm^3/yr$ | 4.19 | 4.19 | 4.19 | 4.19 | 4.19 | 4.19 | 4.19 |
| On-Farm Irrigation Efficiency | % | 43.75 | 70.00 | 43.75 | 70.00 | 43.75 | 70.00 | 43.75 |
| Off-Farm Irrigation Efficiency | % | 12.00 | 72.00 | 12.00 | 72.00 | 12.00 | 72.00 | 12.00 |
| Present Overall Irrigation Efficiency | % | 5.25 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 0.22 | 1.29 | 0.22 | 1.29 | 0.22 | 1.29 | 0.22 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.19 | 0.03 | 0.19 | 0.03 | 0.19 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.15 | 0.90 | 0.15 | 0.90 | 0.15 | 0.90 | 0.15 |
| Dependability 25% | $Mm^3/yr$ | 0.50 | 3.01 | 0.50 | 3.01 | 0.50 | 3.01 | 0.50 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 5 | 32 | 5 | 32 | 5 | 32 | 5 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 1 | 5 | 1 | 5 | 1 | 5 | 1 |
| Dependability 50% | mm/yr | 4 | 22 | 4 | 22 | 4 | 22 | 4 |
| Dependability 25% | mm/yr | 12 | 74 | 12 | 74 | 12 | 74 | 12 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 1.05 | 1.05 | 1.05 | 1.05 | 1.05 | 1.05 | 1.05 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 66.33 | | 66.33 | | 66.33 | | 66.33 |
| Weighted Mean | $Mm^3/yr$ | 1.19 | 0.65 | 1.19 | 0.65 | 1.19 | 0.65 | 1.19 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.18 | 0.10 | 0.18 | 0.10 | 0.18 | 0.10 | 0.18 |
| Dependability 50% | $Mm^3/yr$ | 0.83 | 0.45 | 0.83 | 0.45 | 0.83 | 0.45 | 0.83 |
| Dependability 25% | $Mm^3/yr$ | 2.78 | 1.51 | 2.78 | 1.51 | 2.78 | 1.51 | 2.78 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.16 | 0.07 | 0.10 | 0.05 | 0.08 | 0.04 | 0.05 |
| Dependability 90% | $Mm^3/yr$ | 0.16 | 0.07 | 0.10 | 0.05 | 0.08 | 0.04 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.16 | 0.07 | 0.10 | 0.05 | 0.08 | 0.04 | 0.05 |
| Dependability 50% | $Mm^3/yr$ | 0.16 | 0.07 | 0.10 | 0.05 | 0.08 | 0.04 | 0.05 |
| Dependability 25% | $Mm^3/yr$ | 0.16 | 0.07 | 0.10 | 0.05 | 0.08 | 0.04 | 0.05 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 1.35 | 0.71 | 1.29 | 0.70 | 1.27 | 0.68 | 1.25 |
| Dependability 90% | $Mm^3/yr$ | 0.16 | 0.07 | 0.10 | 0.05 | 0.08 | 0.04 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.33 | 0.16 | 0.28 | 0.15 | 0.25 | 0.13 | 0.23 |
| Dependability 50% | $Mm^3/yr$ | 0.98 | 0.52 | 0.93 | 0.50 | 0.90 | 0.48 | 0.88 |
| Dependability 25% | $Mm^3/yr$ | 2.93 | 1.58 | 2.88 | 1.56 | 2.85 | 1.54 | 2.83 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 90% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 50% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Dependability 25% | $Mm^3/yr$ | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 1.37 | 0.76 | 1.34 | 0.75 | 1.32 | 0.74 | 1.30 |
| Dependability 90% | $Mm^3/yr$ | 0.18 | 0.11 | 0.15 | 0.10 | 0.13 | 0.09 | 0.11 |
| Dependability 75% | $Mm^3/yr$ | 0.36 | 0.21 | 0.32 | 0.20 | 0.30 | 0.19 | 0.29 |
| Dependability 50% | $Mm^3/yr$ | 1.01 | 0.56 | 0.97 | 0.55 | 0.95 | 0.54 | 0.94 |
| Dependability 25% | $Mm^3/yr$ | 2.96 | 1.62 | 2.92 | 1.61 | 2.90 | 1.60 | 2.89 |
| | $Mm^3/yr$ | 1.89 | 1.10 | 1.68 | 1.00 | 1.57 | 0.92 | 1.48 |
| Dependability 90% | $Mm^3/yr$ | 0.70 | 0.45 | 0.49 | 0.35 | 0.38 | 0.27 | 0.29 |
| Dependability 75% | $Mm^3/yr$ | 0.88 | 0.55 | 0.66 | 0.45 | 0.55 | 0.37 | 0.47 |
| Dependability 50% | $Mm^3/yr$ | 1.53 | 0.90 | 1.31 | 0.80 | 1.20 | 0.72 | 1.12 |
| Dependability 25% | $Mm^3/yr$ | 3.48 | 1.96 | 3.26 | 1.86 | 3.15 | 1.78 | 3.07 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 1.79 | 1.10 | 1.64 | 1.00 | 1.57 | 0.92 | 1.48 |
| Dependability 90% | $Mm^3/yr$ | 0.70 | 0.45 | 0.49 | 0.35 | 0.38 | 0.27 | 0.29 |
| Dependability 75% | $Mm^3/yr$ | 0.88 | 0.55 | 0.66 | 0.45 | 0.55 | 0.37 | 0.47 |
| Dependability 50% | $Mm^3/yr$ | 1.53 | 0.90 | 1.31 | 0.80 | 1.20 | 0.72 | 1.12 |
| Dependability 25% | $Mm^3/yr$ | 3.15 | 1.96 | 3.15 | 1.86 | 3.15 | 1.78 | 3.07 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 44 | 27 | 40 | 24 | 38 | 23 | 36 |
| | Dependability 90% | mm/yr | 17 | 11 | 12 | 9 | 9 | 7 | 7 |
| | Dependability 75% | mm/yr | 22 | 13 | 16 | 11 | 14 | 9 | 11 |
| | Dependability 50% | mm/yr | 37 | 22 | 32 | 20 | 29 | 18 | 27 |
| | Dependability 25% | mm/yr | 77 | 48 | 77 | 45 | 77 | 44 | 75 |
| Well Yield | | $10^3 m^3/yr$ | 27 | | | | | | |
| No. of Irrigation Wells | Existing | | 116 | 116 | 116 | 116 | 116 | 116 | 116 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 2.00 | 2.39 | 1.86 | 2.29 | 1.78 | 2.21 | 1.70 |
| | Dependability 90% | $Mm^3/yr$ | 0.70 | 0.45 | 0.49 | 0.35 | 0.38 | 0.27 | 0.29 |
| | Dependability 75% | $Mm^3/yr$ | 0.91 | 0.74 | 0.69 | 0.64 | 0.59 | 0.56 | 0.50 |
| | Dependability 50% | $Mm^3/yr$ | 1.68 | 1.80 | 1.46 | 1.70 | 1.35 | 1.62 | 1.27 |
| | Dependability 25% | $Mm^3/yr$ | 3.65 | 4.97 | 3.65 | 4.87 | 3.65 | 4.80 | 3.57 |
| Depth | ted Mean | mm/yr | 49 | 59 | 45 | 56 | 44 | 54 | 42 |
| | Dependability 90% | mm/yr | 17 | 11 | 12 | 9 | 9 | 7 | 7 |
| | Dependability 75% | mm/yr | 22 | 18 | 17 | 16 | 14 | 14 | 12 |
| | Dependability 50% | mm/yr | 41 | 44 | 36 | 42 | 33 | 40 | 31 |
| | Dependability 25% | mm/yr | 89 | 122 | 89 | 119 | 89 | 117 | 87 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11285 | | | | | | |
| | Total | Mill.Rs. | | 46.12 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 46.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.53 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.95 | 0.58 | 0.87 | 0.53 | 0.83 | 0.49 | 0.79 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 0.95 | 0.58 | 0.87 | 0.53 | 0.83 | 0.49 | 0.79 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 0.95 | 0.58 | 0.87 | 0.53 | 0.83 | 0.49 | 0.79 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.200 | 0.290 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Narain Sagar Jalia Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Ajmer |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.2 | 0.29 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 4087 | 4087 | 4087 | 4087 | 4087 | 4087 | 4087 |
| SW On-Farm Irrigation Efficiency | % | 43.75 | 70.00 | 43.75 | 70.00 | 43.75 | 70.00 | 43.75 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.03 | 0.19 | 0.03 | 0.19 | 0.03 | 0.19 | 0.03 |
| Dependability 50% | $Mm^3/yr$ | 0.15 | 0.90 | 0.15 | 0.90 | 0.15 | 0.90 | 0.15 |
| Dependability 25% | $Mm^3/yr$ | 0.50 | 3.01 | 0.50 | 3.01 | 0.50 | 3.01 | 0.50 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.70 | 0.45 | 0.49 | 0.35 | 0.38 | 0.27 | 0.29 |
| Dependability 75% | $Mm^3/yr$ | 0.88 | 0.55 | 0.66 | 0.45 | 0.55 | 0.37 | 0.47 |
| Dependability 50% | $Mm^3/yr$ | 1.53 | 0.90 | 1.31 | 0.80 | 1.20 | 0.72 | 1.12 |
| Dependability 25% | $Mm^3/yr$ | 3.48 | 1.96 | 3.26 | 1.86 | 3.15 | 1.78 | 3.07 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.70 | 0.45 | 0.49 | 0.35 | 0.38 | 0.27 | 0.29 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 7.46 | 11.00 | 7.42 | 13.53 | 9.10 | 15.70 | 10.41 |
| CMLP Irrig. Intensity Dependability 90% | % | 2.95 | 2.16 | 2.01 | 1.65 | 1.53 | 1.29 | 1.19 |
| Dependability 75% | % | 3.79 | 3.48 | 2.83 | 2.95 | 2.35 | 2.59 | 2.00 |
| Dependability 50% | % | 6.88 | 8.34 | 5.87 | 7.73 | 5.34 | 7.37 | 4.99 |
| Dependability 25% | % | 14.74 | 23.17 | 14.52 | 22.09 | 14.29 | 21.72 | 13.96 |
| Weighted Mean | % | 8.15 | 11.15 | 7.42 | 10.42 | 7.01 | 10.05 | 6.67 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 96.27 | 73.06 | 95.04 | 68.92 | 94.21 | 64.53 | 93.23 |
| Dependability 50% | % | 89.80 | 42.44 | 90.35 | 40.68 | 87.19 | 37.75 | 86.35 |
| Dependability 25% | % | 86.89 | 27.72 | 82.30 | 27.35 | 86.87 | 26.14 | 86.48 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.09 | 0.00 | 5.09 | 0.00 | 5.09 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 0.95 | 5.67 | 0.87 | 5.62 | 0.83 | 5.58 | 0.79 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.09 | 0.00 | 5.09 | 0.00 | 5.09 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 0.95 | 5.67 | 0.87 | 5.62 | 0.83 | 5.58 | 0.79 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 7.46 | 11.00 | 7.42 | 13.53 | 9.10 | 15.70 | 10.41 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 1.26 | 1.73 | 1.16 | 1.65 | 1.11 | 1.60 | 1.06 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 2.00 | 2.39 | 1.86 | 2.29 | 1.78 | 2.21 | 1.70 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 14.61 | 11.34 | 3.27 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 14.61 | 11.34 | 3.27 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 72.01 | 48.51 | 23.51 |
| 5. Total Project Costs | Mill.Rs. | | 34.94 | 5.30 | 29.64 |
| 6. Project Capital Costs | Mill.Rs. | | 31.43 | 0.00 | 31.43 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 34.94 | 5.30 | 29.64 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 31.43 | 0.00 | 31.43 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 37.07 | 43.20 | -6.13 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 2.39 | 0.47 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7691 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.82 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.80** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Rajsamand Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | 457 | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | NANDSAMAND |
| District | RAJSAMAND | Name(s): | |
| Groundwater Potential Zone (PZ) | RAJSAMAND,SAHARA | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 432.865 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 97.03 | Code: | |
| Present Dead Storage, $Mm^3$ | 7.1 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 3.680 | 3.680 | 3.680 | 3.680 | 3.680 | 3.680 | 3.680 |
| | From GW | $Mm^3/yr$ | 0.25 | 0.33 | 0.33 | 0.46 | 0.46 | 0.57 | 0.57 |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.62 | 1.22 | 1.22 | 1.43 | 1.43 | 1.55 | 1.55 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.50 | 0.53 | 0.53 | 0.59 | 0.59 | 0.64 | 0.64 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 10,450 | 10,450 | 10,450 | 10,450 | 10,450 | 10,450 | 10,450 |
| 2006 Irrigation (Gross) | | $Mm^3/yr$ | 53.95 | | | | | | |
| 2006 Irrigated Area | | ha | 3640 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 6.23 | 6.23 | 6.23 | 6.23 | 6.23 | 6.23 | 6.23 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.32 |
| | Dependability 50% | $Mm^3/yr$ | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | Dependability 25% | $Mm^3/yr$ | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 |
| | Weighted Mean | $Mm^3/yr$ | 2.18 | 2.18 | 2.18 | 2.18 | 2.18 | 2.18 | 2.18 |
| Losses from Reservoir | Annual | % | 12.78 | | | | | | |
| | During the Rabi Season | % | 6.14 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.06 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.57 | 0.57 | 1.70 | 1.70 | 2.84 | 2.84 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 97.03 | 96.72 | 96.72 | 96.09 | 96.09 | 95.47 | 95.47 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 |
| | Dependability 25% | $Mm^3/yr$ | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 | 10.44 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 2.26 | 2.26 | 2.26 | 2.26 | 2.26 | 2.26 | 2.26 |
| Dependability 25% | $Mm^3/yr$ | 31.99 | 31.99 | 31.99 | 31.99 | 31.99 | 31.99 | 31.99 |
| On-Farm Irrigation Efficiency | % | 56.01 | 70.00 | 56.01 | 70.00 | 56.01 | 70.00 | 56.01 |
| Off-Farm Irrigation Efficiency | % | 29.71 | 72.00 | 29.71 | 72.00 | 29.71 | 72.00 | 29.71 |
| Present Overall Irrigation Efficiency | % | 16.64 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 3.10 | 7.51 | 3.10 | 7.51 | 3.10 | 7.51 | 3.10 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.67 | 1.63 | 0.67 | 1.63 | 0.67 | 1.63 | 0.67 |
| Dependability 25% | $Mm^3/yr$ | 9.50 | 23.03 | 9.50 | 23.03 | 9.50 | 23.03 | 9.50 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 30 | 72 | 30 | 72 | 30 | 72 | 30 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 50% | mm/yr | 6 | 16 | 6 | 16 | 6 | 16 | 6 |
| Dependability 25% | mm/yr | 91 | 220 | 91 | 220 | 91 | 220 | 91 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 1.99 | 1.99 | 1.99 | 1.99 | 1.99 | 1.99 | 2.05 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.28 |
| Dependability 50% | $Mm^3/yr$ | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 |
| Dependability 25% | $Mm^3/yr$ | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 58.35 | | 58.35 | | 58.35 | | 58.35 |
| Weighted Mean | $Mm^3/yr$ | 6.09 | 3.76 | 6.09 | 3.76 | 6.09 | 3.76 | 6.09 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 1.32 | 0.81 | 1.32 | 0.81 | 1.32 | 0.81 | 1.32 |
| Dependability 25% | $Mm^3/yr$ | 18.67 | 11.52 | 18.67 | 11.52 | 18.67 | 11.52 | 18.67 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.34 | 0.09 | 0.13 | 0.01 | 0.01 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.34 | 0.09 | 0.13 | 0.01 | 0.01 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.34 | 0.09 | 0.13 | 0.01 | 0.01 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.34 | 0.09 | 0.13 | 0.01 | 0.01 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.34 | 0.09 | 0.13 | 0.01 | 0.01 | 0.00 | 0.00 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 6.43 | 3.84 | 6.22 | 3.76 | 6.10 | 3.76 | 6.09 |
| Dependability 90% | $Mm^3/yr$ | 0.34 | 0.09 | 0.13 | 0.01 | 0.01 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.34 | 0.09 | 0.13 | 0.01 | 0.01 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 1.66 | 0.90 | 1.45 | 0.82 | 1.33 | 0.81 | 1.32 |
| Dependability 25% | $Mm^3/yr$ | 19.01 | 11.60 | 18.79 | 11.52 | 18.67 | 11.52 | 18.67 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.62 | 0.66 | 0.67 | 0.66 | 0.66 | 0.62 | 0.64 |
| Dependability 90% | $Mm^3/yr$ | 0.16 | 0.23 | 0.23 | 0.27 | 0.27 | 0.29 | 0.29 |
| Dependability 75% | $Mm^3/yr$ | 0.16 | 0.23 | 0.23 | 0.27 | 0.27 | 0.29 | 0.34 |
| Dependability 50% | $Mm^3/yr$ | 1.01 | 1.04 | 1.04 | 0.99 | 0.98 | 0.91 | 0.91 |
| Dependability 25% | $Mm^3/yr$ | 1.01 | 1.04 | 1.04 | 0.99 | 0.98 | 0.91 | 0.91 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 7.05 | 4.51 | 6.89 | 4.42 | 6.76 | 4.38 | 6.73 |
| Dependability 90% | $Mm^3/yr$ | 0.50 | 0.32 | 0.36 | 0.28 | 0.28 | 0.29 | 0.29 |
| Dependability 75% | $Mm^3/yr$ | 0.50 | 0.32 | 0.36 | 0.28 | 0.28 | 0.29 | 0.34 |
| Dependability 50% | $Mm^3/yr$ | 2.67 | 1.94 | 2.49 | 1.81 | 2.31 | 1.72 | 2.23 |
| Dependability 25% | $Mm^3/yr$ | 20.02 | 12.64 | 19.83 | 12.51 | 19.66 | 12.42 | 19.57 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 8.19 | 4.94 | 7.32 | 4.45 | 6.79 | 4.14 | 6.48 |
| Dependability 90% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.04 |
| Dependability 75% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.09 |
| Dependability 50% | $Mm^3/yr$ | 3.81 | 2.37 | 2.92 | 1.83 | 2.34 | 1.47 | 1.98 |
| Dependability 25% | $Mm^3/yr$ | 21.15 | 13.07 | 20.26 | 12.53 | 19.69 | 12.18 | 19.32 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 5.51 | 4.77 | 4.91 | 4.44 | 4.56 | 4.14 | 4.36 |
| Dependability 90% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.04 |
| Dependability 75% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.09 |
| Dependability 50% | $Mm^3/yr$ | 3.81 | 2.37 | 2.92 | 1.83 | 2.34 | 1.47 | 1.98 |
| Dependability 25% | $Mm^3/yr$ | 12.51 | 12.51 | 12.51 | 12.51 | 12.51 | 12.18 | 12.51 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 53 | 46 | 47 | 42 | 44 | 40 | 42 |
| | Dependability 90% | mm/yr | 16 | 7 | 8 | 3 | 3 | 0 | 0 |
| | Dependability 75% | mm/yr | 16 | 7 | 8 | 3 | 3 | 0 | 1 |
| | Dependability 50% | mm/yr | 36 | 23 | 28 | 18 | 22 | 14 | 19 |
| | Dependability 25% | mm/yr | 120 | 120 | 120 | 120 | 120 | 117 | 120 |
| Well Yield | | $10^3 m^3/yr$ | 9 | | | | | | |
| No. of Irrigation Wells | Existing | | 1374 | 1374 | 1374 | 1374 | 1374 | 1374 | 1374 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 12.51 | 12.51 | 12.51 | 12.51 | 12.51 | 12.51 | 12.51 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 8.61 | 12.28 | 8.01 | 11.96 | 7.66 | 11.65 | 7.46 |
| | Dependability 90% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.04 |
| | Dependability 75% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.09 |
| | Dependability 50% | $Mm^3/yr$ | 4.48 | 4.00 | 3.59 | 3.46 | 3.02 | 3.10 | 2.65 |
| | Dependability 25% | $Mm^3/yr$ | 22.01 | 35.54 | 22.01 | 35.54 | 22.01 | 35.21 | 22.01 |
| Depth | ted Mean | mm/yr | 82 | 118 | 77 | 114 | 73 | 111 | 71 |
| | Dependability 90% | mm/yr | 16 | 7 | 8 | 3 | 3 | 0 | 0 |
| | Dependability 75% | mm/yr | 16 | 7 | 8 | 3 | 3 | 0 | 1 |
| | Dependability 50% | mm/yr | 43 | 38 | 34 | 33 | 29 | 30 | 25 |
| | Dependability 25% | mm/yr | 211 | 340 | 211 | 340 | 211 | 337 | 211 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.15 | 0.63 | 0.63 | 1.17 | 1.17 | 2.12 | 2.13 |
| | Annual Irrigation Depth | mm | 1.45 | 5.99 | 6.00 | 11.19 | 11.18 | 20.32 | 20.33 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9821 | | | | | | |
| | Total | Mill.Rs. | | 102.63 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 102.63 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.55 | | | | | | |
| Average Annual Cost | Mill.Rs | 3.03 | 2.62 | 2.70 | 2.44 | 2.51 | 2.27 | 2.40 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 3.03 | 2.62 | 2.70 | 2.44 | 2.51 | 2.27 | 2.40 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 3.03 | 2.62 | 2.70 | 2.44 | 2.51 | 2.27 | 2.40 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.230 | 0.230 | 0.230 | 0.310 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Rajsamand Irrigation Project |
| WRIS Project Code: | 457 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | RAJSAMAND |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.23 | 0.23 | 0.23 | 0.31 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 10450 | 10450 | 10450 | 10450 | 10450 | 10450 | 10450 |
| SW On-Farm Irrigation Efficiency | % | 56.01 | 70.00 | 56.01 | 70.00 | 56.01 | 70.00 | 56.01 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.67 | 1.63 | 0.67 | 1.63 | 0.67 | 1.63 | 0.67 |
| Dependability 25% | $Mm^3/yr$ | 9.50 | 23.03 | 9.50 | 23.03 | 9.50 | 23.03 | 9.50 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.04 |
| Dependability 75% | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.09 |
| Dependability 50% | $Mm^3/yr$ | 3.81 | 2.37 | 2.92 | 1.83 | 2.34 | 1.47 | 1.98 |
| Dependability 25% | $Mm^3/yr$ | 21.15 | 13.07 | 20.26 | 12.53 | 19.69 | 12.18 | 19.32 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.64 | 0.75 | 0.79 | 0.31 | 0.31 | 0.05 | 0.04 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 12.51 | 12.51 | 12.51 | 12.51 | 12.51 | 12.51 | 12.51 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 39.59 | 58.46 | 32.64 | 67.41 | 36.89 | 75.51 | 41.30 |
| CMLP Irrig. Intensity Dependability 90% | % | 2.63 | 1.43 | 1.30 | 0.59 | 0.52 | 0.09 | 0.07 |
| Dependability 75% | % | 2.64 | 1.43 | 1.31 | 0.59 | 0.52 | 0.09 | 0.15 |
| Dependability 50% | % | 7.08 | 7.45 | 5.80 | 6.48 | 4.89 | 5.78 | 4.28 |
| Dependability 25% | % | 33.48 | 65.96 | 34.41 | 65.83 | 34.73 | 65.18 | 34.72 |
| Weighted Mean | % | 13.22 | 22.82 | 12.60 | 22.17 | 12.13 | 21.58 | 11.80 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 50% | % | 84.58 | 54.95 | 80.33 | 49.37 | 76.72 | 43.39 | 73.32 |
| Dependability 25% | % | 49.88 | 26.13 | 50.77 | 28.11 | 52.78 | 25.94 | 52.77 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 11.32 | 0.00 | 11.32 | 0.00 | 11.32 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 3.03 | 13.95 | 2.70 | 13.77 | 2.51 | 13.60 | 2.40 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 11.32 | 0.00 | 11.32 | 0.00 | 11.32 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 3.03 | 13.95 | 2.70 | 13.77 | 2.51 | 13.60 | 2.40 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 39.59 | 58.46 | 32.64 | 67.41 | 36.89 | 75.51 | 41.30 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 5.32 | 8.84 | 4.93 | 8.59 | 4.70 | 8.36 | 4.57 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 8.61 | 12.28 | 8.01 | 11.96 | 7.66 | 11.65 | 7.46 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 1.99 | 1.99 | 1.99 | 1.99 | 1.99 | 1.99 | 2.05 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 87.61 | 61.23 | 26.38 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 75.33 | 48.94 | 26.39 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 12.27 | 12.29 | -0.01 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 375.61 | 208.60 | 167.01 |
| 5. Total Project Costs | Mill.Rs. | | 85.85 | 16.39 | 69.46 |
| 6. Project Capital Costs | Mill.Rs. | | 69.94 | 0.00 | 69.94 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 85.85 | 16.39 | 69.46 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 69.94 | 0.00 | 69.94 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 289.76 | 192.22 | 97.54 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.98 | 0.27 | |
| 2. Priority Sectors Use | % | | 14.01 | 20.07 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6693 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.14 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **2.39** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Sardar Samand Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Luni | Linked to Project(s): | |
| District | Pali | Name(s): | |
| Groundwater Potential Zone (PZ) | Rohat,Sojat | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 2064 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 45.78 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.50 | 0.78 | 0.78 | 0.88 | 0.88 | 0.96 | 0.96 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.24 | 0.26 | 0.26 | 0.28 | 0.28 | 0.31 | 0.31 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 10,325 | 10,325 | 10,325 | 10,325 | 10,325 | 10,325 | 10,325 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 63.59 | | | | | | |
| 2010 Irrigated Area | | ha | 5139 | | | | | | |

### III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 50.52 | 50.52 | 50.52 | 50.52 | 50.52 | 50.52 | 50.52 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Dependability 50% | $Mm^3/yr$ | 2.52 | 2.52 | 2.52 | 2.52 | 2.52 | 2.52 | 2.52 |
| Dependability 25% | $Mm^3/yr$ | 58.68 | 58.68 | 58.68 | 58.68 | 58.68 | 58.68 | 58.68 |
| Weighted Mean | $Mm^3/yr$ | 21.63 | 21.63 | 21.63 | 21.63 | 21.63 | 21.63 | 21.63 |
| Losses from Reservoir Annual | % | 10.48 | | | | | | |
| During the Rabi Season | % | 5.00 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 194.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.40 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 4.00 | 4.00 | 12.01 | 12.01 | 20.02 | 20.02 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 45.78 | 41.78 | 41.78 | 33.77 | 33.77 | 25.76 | 25.76 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 16.14 | 14.77 | 14.77 | 12.03 | 12.03 | 9.29 | 9.29 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Dependability 50% | $Mm^3/yr$ | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 | 2.39 |
| Dependability 25% | $Mm^3/yr$ | 43.49 | 39.69 | 39.69 | 32.08 | 32.08 | 24.47 | 24.47 |
| On-Farm Irrigation Efficiency | % | 62.00 | 70.00 | 62.00 | 70.00 | 62.00 | 70.00 | 62.00 |
| Off-Farm Irrigation Efficiency | % | 36.76 | 72.00 | 36.76 | 72.00 | 36.76 | 72.00 | 36.76 |
| Present Overall Irrigation Efficiency | % | 22.79 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 5.93 | 10.63 | 5.43 | 8.66 | 4.42 | 6.69 | 3.42 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Dependability 50% | $Mm^3/yr$ | 0.88 | 1.72 | 0.88 | 1.72 | 0.88 | 1.72 | 0.88 |
| Dependability 25% | $Mm^3/yr$ | 15.99 | 28.57 | 14.59 | 23.10 | 11.79 | 17.62 | 9.00 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 57 | 103 | 53 | 84 | 43 | 65 | 33 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 50% | mm/yr | 9 | 17 | 9 | 17 | 9 | 17 | 9 |
| Dependability 25% | mm/yr | 155 | 277 | 141 | 224 | 114 | 171 | 87 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 10.87 | 9.92 | 9.92 | 8.02 | 8.02 | 6.12 | 6.12 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 4.64 | 6.09 | 6.09 | 8.97 | 8.97 | 11.85 | 11.85 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 12.90 | 16.90 | 16.90 | 24.91 | 24.91 | 32.92 | 32.92 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 2.27 | 2.27 | 2.27 | 2.27 | 2.27 | 2.27 | 2.27 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 54.05 | | 54.05 | | 54.05 | | 54.05 |
| Weighted Mean | $Mm^3/yr$ | 8.72 | 5.32 | 7.98 | 4.33 | 6.50 | 3.35 | 5.02 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Dependability 50% | $Mm^3/yr$ | 1.29 | 0.86 | 1.29 | 0.86 | 1.29 | 0.86 | 1.29 |
| Dependability 25% | $Mm^3/yr$ | 23.51 | 14.29 | 21.45 | 11.55 | 17.34 | 8.81 | 13.23 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.45 | 0.25 | 0.37 | 0.22 | 0.33 | 0.20 | 0.30 |
| Dependability 90% | $Mm^3/yr$ | 0.45 | 0.25 | 0.37 | 0.22 | 0.33 | 0.20 | 0.30 |
| Dependability 75% | $Mm^3/yr$ | 0.45 | 0.25 | 0.37 | 0.22 | 0.33 | 0.20 | 0.30 |
| Dependability 50% | $Mm^3/yr$ | 0.45 | 0.25 | 0.37 | 0.22 | 0.33 | 0.20 | 0.30 |
| Dependability 25% | $Mm^3/yr$ | 0.45 | 0.25 | 0.37 | 0.22 | 0.33 | 0.20 | 0.30 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 9.18 | 5.56 | 8.35 | 4.55 | 6.84 | 3.55 | 5.32 |
| Dependability 90% | $Mm^3/yr$ | 0.45 | 0.25 | 0.37 | 0.22 | 0.33 | 0.20 | 0.30 |
| Dependability 75% | $Mm^3/yr$ | 0.46 | 0.25 | 0.38 | 0.23 | 0.34 | 0.21 | 0.31 |
| Dependability 50% | $Mm^3/yr$ | 1.75 | 1.11 | 1.66 | 1.08 | 1.63 | 1.06 | 1.59 |
| Dependability 25% | $Mm^3/yr$ | 23.96 | 14.53 | 21.82 | 11.77 | 17.67 | 9.01 | 13.53 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total nted Mean | $Mm^3/yr$ | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 90% | $Mm^3/yr$ | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 75% | $Mm^3/yr$ | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 50% | $Mm^3/yr$ | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Dependability 25% | $Mm^3/yr$ | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 |
| Total Return Flows: nted Mean | $Mm^3/yr$ | 9.24 | 5.66 | 8.45 | 4.66 | 6.94 | 3.66 | 5.44 |
| Dependability 90% | $Mm^3/yr$ | 0.52 | 0.34 | 0.46 | 0.33 | 0.44 | 0.32 | 0.42 |
| Dependability 75% | $Mm^3/yr$ | 0.53 | 0.35 | 0.47 | 0.33 | 0.45 | 0.32 | 0.43 |
| Dependability 50% | $Mm^3/yr$ | 1.82 | 1.20 | 1.76 | 1.19 | 1.73 | 1.18 | 1.71 |
| Dependability 25% | $Mm^3/yr$ | 24.03 | 14.63 | 21.91 | 11.88 | 17.78 | 9.13 | 13.64 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 10.77 | 6.89 | 9.68 | 5.77 | 8.05 | 4.66 | 6.44 |
| Dependability 90% | $Mm^3/yr$ | 2.05 | 1.57 | 1.69 | 1.44 | 1.55 | 1.32 | 1.42 |
| Dependability 75% | $Mm^3/yr$ | 2.06 | 1.58 | 1.70 | 1.45 | 1.56 | 1.32 | 1.43 |
| Dependability 50% | $Mm^3/yr$ | 3.35 | 2.43 | 2.99 | 2.30 | 2.85 | 2.18 | 2.71 |
| Dependability 25% | $Mm^3/yr$ | 25.56 | 15.86 | 23.14 | 12.99 | 18.89 | 10.13 | 14.64 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 2.17 | 4.40 | 5.87 | 4.32 | 5.78 | 4.24 | 5.70 |
| Dependability 90% | $Mm^3/yr$ | 2.05 | 1.57 | 1.69 | 1.44 | 1.55 | 1.32 | 1.42 |
| Dependability 75% | $Mm^3/yr$ | 2.06 | 1.58 | 1.70 | 1.45 | 1.56 | 1.32 | 1.43 |
| Dependability 50% | $Mm^3/yr$ | 2.26 | 2.43 | 2.99 | 2.30 | 2.85 | 2.18 | 2.71 |
| Dependability 25% | $Mm^3/yr$ | 2.26 | 8.96 | 12.58 | 8.96 | 12.58 | 8.96 | 12.58 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 21 | 43 | 57 | 42 | 56 | 41 | 55 |
| | Dependability 90% | mm/yr | 20 | 15 | 16 | 14 | 15 | 13 | 14 |
| | Dependability 75% | mm/yr | 20 | 15 | 17 | 14 | 15 | 13 | 14 |
| | Dependability 50% | mm/yr | 22 | 24 | 29 | 22 | 28 | 21 | 26 |
| | Dependability 25% | mm/yr | 22 | 87 | 122 | 87 | 122 | 87 | 122 |
| Well Yield | | $10^3 m^3/yr$ | 22 | | | | | | |
| No. of Irrigation Wells | Existing | | 104 | 104 | 104 | 413 | 580 | 413 | 580 |
| | Additional | | | 309 | 476 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 2.26 | 8.96 | 12.58 | 8.96 | 12.58 | 8.96 | 12.58 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 0.45 | 1.79 | 2.52 | 1.79 | 2.52 | 1.79 | 2.52 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 8.10 | 15.04 | 11.30 | 12.98 | 10.21 | 10.93 | 9.11 |
| | Dependability 90% | $Mm^3/yr$ | 2.05 | 1.57 | 1.69 | 1.44 | 1.55 | 1.32 | 1.42 |
| | Dependability 75% | $Mm^3/yr$ | 2.07 | 1.59 | 1.71 | 1.46 | 1.57 | 1.34 | 1.43 |
| | Dependability 50% | $Mm^3/yr$ | 3.14 | 4.16 | 3.87 | 4.03 | 3.73 | 3.90 | 3.59 |
| | Dependability 25% | $Mm^3/yr$ | 18.24 | 37.53 | 27.17 | 32.05 | 24.37 | 26.58 | 21.58 |
| Depth | ted Mean | mm/yr | 78 | 146 | 109 | 126 | 99 | 106 | 88 |
| | Dependability 90% | mm/yr | 20 | 15 | 16 | 14 | 15 | 13 | 14 |
| | Dependability 75% | mm/yr | 20 | 15 | 17 | 14 | 15 | 13 | 14 |
| | Dependability 50% | mm/yr | 30 | 40 | 37 | 39 | 36 | 38 | 35 |
| | Dependability 25% | mm/yr | 177 | 364 | 263 | 310 | 236 | 257 | 209 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 7500 | | | | | | |
| | Total | Mill.Rs. | | 77.44 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | 46 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 14.13 | 21.76 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | 18 | | | | | | |
| | Total | Mill.Rs. | 0.00 | 5.56 | 8.57 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 97.13 | 30.33 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.14 | 0.22 | 0.14 | 0.22 | 0.14 | 0.22 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.28 | 0.43 | 0.28 | 0.43 | 0.28 | 0.43 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.46 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.00 | 2.03 | 2.70 | 1.99 | 2.66 | 1.95 | 2.62 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.00 | 2.03 | 2.70 | 1.99 | 2.66 | 1.95 | 2.62 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 1.00 | 2.45 | 3.35 | 2.41 | 3.31 | 2.37 | 3.27 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.230 | 0.210 | 0.200 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Sardar Samand Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Luni |
| Irrigation Demand Zone (IDZ) | Pali |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.23 | 0.21 | 0.2 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 10325 | 10325 | 10325 | 10325 | 10325 | 10325 | 10325 |
| SW On-Farm Irrigation Efficiency | % | 62.00 | 70.00 | 62.00 | 70.00 | 62.00 | 70.00 | 62.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Dependability 50% | $Mm^3/yr$ | 0.88 | 1.72 | 0.88 | 1.72 | 0.88 | 1.72 | 0.88 |
| Dependability 25% | $Mm^3/yr$ | 15.99 | 28.57 | 14.59 | 23.10 | 11.79 | 17.62 | 9.00 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.05 | 1.57 | 1.69 | 1.44 | 1.55 | 1.32 | 1.42 |
| Dependability 75% | $Mm^3/yr$ | 2.06 | 1.58 | 1.70 | 1.45 | 1.56 | 1.32 | 1.43 |
| Dependability 50% | $Mm^3/yr$ | 3.35 | 2.43 | 2.99 | 2.30 | 2.85 | 2.18 | 2.71 |
| Dependability 25% | $Mm^3/yr$ | 25.56 | 15.86 | 23.14 | 12.99 | 18.89 | 10.13 | 14.64 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.05 | 1.57 | 1.69 | 1.44 | 1.55 | 1.32 | 1.42 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 2.26 | 8.96 | 12.58 | 8.96 | 12.58 | 8.96 | 12.58 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 0.45 | 1.79 | 2.52 | 1.79 | 2.52 | 1.79 | 2.52 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 24.53 | 58.84 | 39.86 | 62.07 | 43.36 | 74.03 | 54.79 |
| CMLP Irrig. Intensity Dependability 90% | % | 3.43 | 3.18 | 2.97 | 3.06 | 2.86 | 2.80 | 2.61 |
| Dependability 75% | % | 3.46 | 3.22 | 3.00 | 3.11 | 2.90 | 2.84 | 2.64 |
| Dependability 50% | % | 5.20 | 8.22 | 6.75 | 8.38 | 6.84 | 8.11 | 6.59 |
| Dependability 25% | % | 32.22 | 76.55 | 46.84 | 65.58 | 44.39 | 54.59 | 39.42 |
| Weighted Mean | % | 14.15 | 30.61 | 19.53 | 26.64 | 18.61 | 22.52 | 16.66 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 99.64 | 99.10 | 99.57 | 99.05 | 99.55 | 98.96 | 99.50 |
| Dependability 50% | % | 69.50 | 55.07 | 75.92 | 55.94 | 75.42 | 54.51 | 74.49 |
| Dependability 25% | % | 9.12 | 16.86 | 37.86 | 24.91 | 49.14 | 30.94 | 56.16 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 10.78 | 3.44 | 10.78 | 3.44 | 10.78 | 3.44 |
| Annuity Total Project Cost | Mill.Rs./yr | 1.00 | 13.22 | 6.79 | 13.19 | 6.75 | 13.15 | 6.71 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 10.78 | 3.44 | 10.78 | 3.44 | 10.78 | 3.44 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 1.00 | 13.22 | 6.79 | 13.19 | 6.75 | 13.15 | 6.71 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 24.53 | 58.84 | 39.86 | 62.07 | 43.36 | 74.03 | 54.79 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 5.09 | 10.75 | 7.18 | 9.30 | 6.50 | 7.86 | 5.82 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 8.10 | 15.04 | 11.30 | 12.98 | 10.21 | 10.93 | 9.11 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 89.51 | 68.01 | 21.50 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 89.51 | 68.01 | 21.50 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 370.36 | 253.45 | 116.91 |
| 5. Total Project Costs | Mill.Rs. | | 81.62 | 41.87 | 39.74 |
| 6. Project Capital Costs | Mill.Rs. | | 66.58 | 21.26 | 45.31 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 81.62 | 41.87 | 39.74 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 66.58 | 21.26 | 45.31 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 288.74 | 211.58 | 77.16 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.91 | 0.62 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6448 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.95 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **2.16** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Sareri Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | BHILWARA | Name(s): | |
| Groundwater Potential Zone (PZ) | HURDA | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 369 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 53.138 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.47 | 0.96 | 0.96 | 1.19 | 1.19 | 1.34 | 1.34 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.40 | 0.41 | 0.41 | 0.45 | 0.45 | 0.48 | 0.48 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 9,717 | 13,391 | 9,717 | 13,391 | 9,717 | 13,391 | 9,717 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 11.00 | | | | | | |
| 2010 Irrigated Area | | ha | 2199 | | | | | | |

### III. Water Sources

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 20.71 | 20.71 | 20.71 | 20.71 | 20.71 | 20.71 | 20.71 |
| | Dependability 90% | $Mm^3/yr$ | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| | Dependability 75% | $Mm^3/yr$ | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 |
| | Dependability 50% | $Mm^3/yr$ | 7.70 | 7.70 | 7.70 | 7.70 | 7.70 | 7.70 | 7.70 |
| | Dependability 25% | $Mm^3/yr$ | 28.00 | 28.00 | 28.00 | 28.00 | 28.00 | 28.00 | 28.00 |
| | Weighted Mean | $Mm^3/yr$ | 13.01 | 13.01 | 13.01 | 13.01 | 13.01 | 13.01 | 13.01 |
| Losses from Reservoir | Annual | % | 14.50 | | | | | | |
| | During the Rabi Season | % | 7.28 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.05 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.48 | 0.48 | 1.45 | 1.45 | 2.42 | 2.42 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 53.14 | 52.65 | 52.65 | 51.69 | 51.69 | 50.72 | 50.72 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 12.06 | 12.06 | 12.06 | 12.06 | 12.06 | 12.06 | 12.06 |
| Dependability 90% | $Mm^3/yr$ | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 |
| Dependability 75% | $Mm^3/yr$ | 2.41 | 2.41 | 2.41 | 2.41 | 2.41 | 2.41 | 2.41 |
| Dependability 50% | $Mm^3/yr$ | 7.14 | 7.14 | 7.14 | 7.14 | 7.14 | 7.14 | 7.14 |
| Dependability 25% | $Mm^3/yr$ | 25.96 | 25.96 | 25.96 | 25.96 | 25.96 | 25.96 | 25.96 |
| On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| Off-Farm Irrigation Efficiency | % | 84.50 | 84.50 | 84.50 | 84.50 | 84.50 | 84.50 | 84.50 |
| Present Overall Irrigation Efficiency | % | 47.32 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 |
| Dependability 90% | $Mm^3/yr$ | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 |
| Dependability 75% | $Mm^3/yr$ | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 |
| Dependability 50% | $Mm^3/yr$ | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 |
| Dependability 25% | $Mm^3/yr$ | 21.94 | 21.94 | 21.94 | 21.94 | 21.94 | 21.94 | 21.94 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 105 | 76 | 105 | 76 | 105 | 76 | 105 |
| Dependability 90% | mm/yr | 4 | 3 | 4 | 3 | 4 | 3 | 4 |
| Dependability 75% | mm/yr | 21 | 15 | 21 | 15 | 21 | 15 | 21 |
| Dependability 50% | mm/yr | 62 | 45 | 62 | 45 | 62 | 45 | 62 |
| Dependability 25% | mm/yr | 226 | 164 | 226 | 164 | 226 | 164 | 226 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 6.49 | 6.49 | 6.49 | 6.49 | 6.49 | 6.49 | 6.49 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 2.46 | 2.46 | 2.46 | 2.46 | 2.46 | 2.46 | 2.46 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 10.00 | | 10.00 | | 10.00 | |
| Combined, at present | % | 36.88 | | 36.88 | | 36.88 | | 36.88 |
| Weighted Mean | $Mm^3/yr$ | 4.45 | 3.75 | 4.45 | 3.75 | 4.45 | 3.75 | 4.45 |
| Dependability 90% | $Mm^3/yr$ | 0.17 | 0.14 | 0.17 | 0.14 | 0.17 | 0.14 | 0.17 |
| Dependability 75% | $Mm^3/yr$ | 0.89 | 0.75 | 0.89 | 0.75 | 0.89 | 0.75 | 0.89 |
| Dependability 50% | $Mm^3/yr$ | 2.63 | 2.22 | 2.63 | 2.22 | 2.63 | 2.22 | 2.63 |
| Dependability 25% | $Mm^3/yr$ | 9.57 | 8.08 | 9.57 | 8.08 | 9.57 | 8.08 | 9.57 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.48 | 0.22 | 0.33 | 0.16 | 0.25 | 0.13 | 0.19 |
| Dependability 90% | $Mm^3/yr$ | 0.48 | 0.22 | 0.33 | 0.16 | 0.25 | 0.13 | 0.19 |
| Dependability 75% | $Mm^3/yr$ | 0.48 | 0.22 | 0.33 | 0.16 | 0.25 | 0.13 | 0.19 |
| Dependability 50% | $Mm^3/yr$ | 0.48 | 0.22 | 0.33 | 0.16 | 0.25 | 0.13 | 0.19 |
| Dependability 25% | $Mm^3/yr$ | 0.48 | 0.22 | 0.33 | 0.16 | 0.25 | 0.13 | 0.19 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 4.93 | 3.97 | 4.78 | 3.92 | 4.69 | 3.88 | 4.64 |
| Dependability 90% | $Mm^3/yr$ | 0.65 | 0.36 | 0.50 | 0.31 | 0.42 | 0.27 | 0.36 |
| Dependability 75% | $Mm^3/yr$ | 1.37 | 0.97 | 1.22 | 0.91 | 1.13 | 0.88 | 1.08 |
| Dependability 50% | $Mm^3/yr$ | 3.11 | 2.44 | 2.96 | 2.39 | 2.88 | 2.35 | 2.82 |
| Dependability 25% | $Mm^3/yr$ | 10.05 | 8.30 | 9.90 | 8.24 | 9.82 | 8.21 | 9.77 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.15 | 0.15 | 0.17 | 0.17 |
| Dependability 90% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.15 | 0.15 | 0.17 | 0.17 |
| Dependability 75% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.15 | 0.15 | 0.17 | 0.17 |
| Dependability 50% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.15 | 0.15 | 0.17 | 0.17 |
| Dependability 25% | $Mm^3/yr$ | 0.08 | 0.12 | 0.12 | 0.15 | 0.15 | 0.17 | 0.17 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 5.00 | 4.10 | 4.90 | 4.07 | 4.84 | 4.05 | 4.81 |
| Dependability 90% | $Mm^3/yr$ | 0.73 | 0.49 | 0.62 | 0.46 | 0.57 | 0.44 | 0.53 |
| Dependability 75% | $Mm^3/yr$ | 1.45 | 1.09 | 1.34 | 1.06 | 1.28 | 1.04 | 1.25 |
| Dependability 50% | $Mm^3/yr$ | 3.19 | 2.56 | 3.08 | 2.54 | 3.03 | 2.52 | 2.99 |
| Dependability 25% | $Mm^3/yr$ | 10.13 | 8.42 | 10.03 | 8.39 | 9.97 | 8.37 | 9.93 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 6.59 | 5.19 | 5.99 | 4.89 | 5.66 | 4.69 | 5.45 |
| Dependability 90% | $Mm^3/yr$ | 2.32 | 1.58 | 1.71 | 1.28 | 1.39 | 1.08 | 1.17 |
| Dependability 75% | $Mm^3/yr$ | 3.04 | 2.18 | 2.43 | 1.88 | 2.10 | 1.68 | 1.89 |
| Dependability 50% | $Mm^3/yr$ | 4.78 | 3.65 | 4.17 | 3.36 | 3.85 | 3.16 | 3.63 |
| Dependability 25% | $Mm^3/yr$ | 11.72 | 9.51 | 11.12 | 9.21 | 10.79 | 9.01 | 10.57 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 6.59 | 5.19 | 5.99 | 4.89 | 5.66 | 4.69 | 5.45 |
| Dependability 90% | $Mm^3/yr$ | 2.32 | 1.58 | 1.71 | 1.28 | 1.39 | 1.08 | 1.17 |
| Dependability 75% | $Mm^3/yr$ | 3.04 | 2.18 | 2.43 | 1.88 | 2.10 | 1.68 | 1.89 |
| Dependability 50% | $Mm^3/yr$ | 4.78 | 3.65 | 4.17 | 3.36 | 3.85 | 3.16 | 3.63 |
| Dependability 25% | $Mm^3/yr$ | 11.72 | 9.51 | 11.12 | 9.21 | 10.79 | 9.01 | 10.57 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 68 | 39 | 62 | 36 | 58 | 35 | 56 |
| | Dependability 90% | mm/yr | 24 | 12 | 18 | 10 | 14 | 8 | 12 |
| | Dependability 75% | mm/yr | 31 | 16 | 25 | 14 | 22 | 13 | 19 |
| | Dependability 50% | mm/yr | 49 | 27 | 43 | 25 | 40 | 24 | 37 |
| | Dependability 25% | mm/yr | 121 | 71 | 114 | 69 | 111 | 67 | 109 |
| Well Yield | | $10^3 m^3/yr$ | 17 | | | | | | |
| No. of Irrigation Wells | Existing | | 1060 | 1060 | 1060 | 1060 | 1060 | 1060 | 1060 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 17.61 | 17.61 | 17.61 | 17.61 | 17.61 | 17.61 | 17.61 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 16.79 | 15.38 | 16.18 | 15.08 | 15.86 | 14.88 | 15.64 |
| | Dependability 90% | $Mm^3/yr$ | 2.71 | 1.97 | 2.10 | 1.67 | 1.78 | 1.47 | 1.56 |
| | Dependability 75% | $Mm^3/yr$ | 5.07 | 4.22 | 4.47 | 3.92 | 4.14 | 3.72 | 3.92 |
| | Dependability 50% | $Mm^3/yr$ | 10.81 | 9.69 | 10.21 | 9.39 | 9.88 | 9.19 | 9.66 |
| | Dependability 25% | $Mm^3/yr$ | 33.66 | 31.45 | 33.05 | 31.15 | 32.73 | 30.95 | 32.51 |
| Depth | ted Mean | mm/yr | 173 | 115 | 167 | 113 | 163 | 111 | 161 |
| | Dependability 90% | mm/yr | 28 | 15 | 22 | 12 | 18 | 11 | 16 |
| | Dependability 75% | mm/yr | 52 | 32 | 46 | 29 | 43 | 28 | 40 |
| | Dependability 50% | mm/yr | 111 | 72 | 105 | 70 | 102 | 69 | 99 |
| | Dependability 25% | mm/yr | 346 | 235 | 340 | 233 | 337 | 231 | 335 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 11138 | | | | | | |
| | Total | Mill.Rs. | | 108.23 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 108.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.52 | | | | | | |
| Average Annual Cost | Mill.Rs | 3.43 | 2.70 | 3.11 | 2.54 | 2.94 | 2.44 | 2.83 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 3.43 | 2.70 | 3.11 | 2.54 | 2.94 | 2.44 | 2.83 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 3.43 | 2.70 | 3.11 | 2.54 | 2.94 | 2.44 | 2.83 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.150 | 0.180 | 0.310 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Sareri Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | BHILWARA |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.15 | 0.18 | 0.31 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 9717 | 13391 | 9717 | 13391 | 9717 | 13391 | 9717 |
| SW On-Farm Irrigation Efficiency | % | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 | 70.00 | 56.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 |
| Dependability 75% | $Mm^3/yr$ | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 |
| Dependability 50% | $Mm^3/yr$ | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 |
| Dependability 25% | $Mm^3/yr$ | 21.94 | 21.94 | 21.94 | 21.94 | 21.94 | 21.94 | 21.94 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 2.32 | 1.58 | 1.71 | 1.28 | 1.39 | 1.08 | 1.17 |
| Dependability 75% | $Mm^3/yr$ | 3.04 | 2.18 | 2.43 | 1.88 | 2.10 | 1.68 | 1.89 |
| Dependability 50% | $Mm^3/yr$ | 4.78 | 3.65 | 4.17 | 3.36 | 3.85 | 3.16 | 3.63 |
| Dependability 25% | $Mm^3/yr$ | 11.72 | 9.51 | 11.12 | 9.21 | 10.79 | 9.01 | 10.57 |
| Firm GW for Kharif | $Mm^3/yr$ | 2.32 | 1.58 | 1.71 | 1.28 | 1.39 | 1.08 | 1.17 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 17.61 | 17.61 | 17.61 | 17.61 | 17.61 | 17.61 | 17.61 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 | 3.52 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 73.72 | 76.98 | 67.04 | 90.97 | 79.08 | 106.25 | 92.25 |
| CMLP Irrig. Intensity Dependability 90% | % | 4.59 | 3.02 | 3.81 | 2.48 | 3.11 | 2.18 | 2.71 |
| Dependability 75% | % | 8.30 | 6.37 | 7.80 | 5.72 | 6.97 | 5.42 | 6.58 |
| Dependability 50% | % | 17.36 | 14.55 | 17.53 | 13.66 | 16.42 | 13.35 | 16.02 |
| Dependability 25% | % | 53.38 | 47.11 | 56.32 | 45.24 | 54.03 | 44.93 | 53.63 |
| Weighted Mean | % | 26.78 | 23.07 | 27.69 | 21.92 | 26.26 | 21.62 | 25.86 |
| CMLP GW Use Dependability 90% | % | 85.54 | 80.10 | 81.38 | 76.53 | 77.96 | 73.34 | 74.89 |
| Dependability 75% | % | 58.45 | 50.56 | 53.37 | 47.26 | 50.12 | 44.42 | 47.34 |
| Dependability 50% | % | 38.57 | 33.54 | 37.18 | 33.12 | 36.61 | 31.66 | 35.18 |
| Dependability 25% | % | 25.57 | 23.85 | 27.95 | 25.77 | 29.58 | 25.29 | 29.10 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 11.94 | 0.00 | 11.94 | 0.00 | 11.94 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 3.43 | 14.64 | 3.11 | 14.48 | 2.94 | 14.38 | 2.83 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 11.94 | 0.00 | 11.94 | 0.00 | 11.94 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 3.43 | 14.64 | 3.11 | 14.48 | 2.94 | 14.38 | 2.83 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 73.72 | 76.98 | 67.04 | 90.97 | 79.08 | 106.25 | 92.25 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 9.99 | 11.03 | 9.60 | 10.80 | 9.39 | 10.65 | 9.25 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 16.79 | 15.38 | 16.18 | 15.08 | 15.86 | 14.88 | 15.64 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 94.52 | 99.44 | -4.92 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 94.52 | 99.44 | -4.92 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 498.69 | 434.04 | 64.65 |
| 5. Total Project Costs | Mill.Rs. | | 90.17 | 18.97 | 71.20 |
| 6. Project Capital Costs | Mill.Rs. | | 73.76 | 0.00 | 73.76 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 90.17 | 18.97 | 71.20 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 73.76 | 0.00 | 73.76 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 408.52 | 415.07 | -6.56 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.95 | 0.19 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 5508 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.93 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.91** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Som Kagdar Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Mahi | Linked to Project(s): | |
| District | Dungarpur | Name(s): | |
| Groundwater Potential Zone (PZ) | Dungarpur,Udaipur | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 564 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 33.45 | Code: | |
| Present Dead Storage, $Mm^3$ | 0.65 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.57 | 1.21 | 1.21 | 1.55 | 1.55 | 1.76 | 1.76 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.45 | 0.47 | 0.47 | 0.51 | 0.51 | 0.55 | 0.55 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 5,739 | 5,739 | 5,739 | 5,739 | 5,739 | 5,739 | 5,739 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 21.72 | | | | | | |
| 2010 Irrigated Area | | ha | 1157 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 53.64 | 53.64 | 53.64 | 53.64 | 53.64 | 53.64 | 53.64 |
| | Dependability 90% | $Mm^3/yr$ | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| | Dependability 75% | $Mm^3/yr$ | 1.90 | 1.90 | 1.90 | 1.90 | 1.90 | 1.90 | 1.90 |
| | Dependability 50% | $Mm^3/yr$ | 14.60 | 14.60 | 14.60 | 14.60 | 14.60 | 14.60 | 14.60 |
| | Dependability 25% | $Mm^3/yr$ | 58.60 | 58.60 | 58.60 | 58.60 | 58.60 | 58.60 | 58.60 |
| | Weighted Mean | $Mm^3/yr$ | 23.66 | 23.66 | 23.66 | 23.66 | 23.66 | 23.66 | 23.66 |
| Losses from Reservoir | Annual | % | 9.86 | | | | | | |
| | During the Rabi Season | % | 4.92 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 243.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.14 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 1.37 | 1.37 | 4.11 | 4.11 | 6.85 | 6.85 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 33.45 | 32.70 | 32.70 | 29.99 | 29.99 | 27.25 | 27.25 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 14.24 | 14.01 | 14.01 | 13.18 | 13.18 | 12.35 | 12.35 |
| Dependability 90% | $Mm^3/yr$ | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 |
| Dependability 75% | $Mm^3/yr$ | 1.76 | 1.76 | 1.76 | 1.76 | 1.76 | 1.76 | 1.76 |
| Dependability 50% | $Mm^3/yr$ | 13.54 | 13.54 | 13.54 | 13.54 | 13.54 | 13.54 | 13.54 |
| Dependability 25% | $Mm^3/yr$ | 31.01 | 30.32 | 30.32 | 27.81 | 27.81 | 25.26 | 25.26 |
| On-Farm Irrigation Efficiency | % | 65.91 | 70.00 | 65.91 | 70.00 | 65.91 | 70.00 | 65.91 |
| Off-Farm Irrigation Efficiency | % | 66.00 | 72.00 | 66.00 | 72.00 | 66.00 | 72.00 | 66.00 |
| Present Overall Irrigation Efficiency | % | 43.50 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 9.40 | 10.09 | 9.25 | 9.49 | 8.70 | 8.89 | 8.15 |
| Dependability 90% | $Mm^3/yr$ | 0.31 | 0.33 | 0.31 | 0.33 | 0.31 | 0.33 | 0.31 |
| Dependability 75% | $Mm^3/yr$ | 1.16 | 1.27 | 1.16 | 1.27 | 1.16 | 1.27 | 1.16 |
| Dependability 50% | $Mm^3/yr$ | 8.93 | 9.75 | 8.93 | 9.75 | 8.93 | 9.75 | 8.93 |
| Dependability 25% | $Mm^3/yr$ | 20.47 | 21.83 | 20.01 | 20.02 | 18.35 | 18.19 | 16.67 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 164 | 176 | 161 | 165 | 152 | 155 | 142 |
| Dependability 90% | mm/yr | 5 | 6 | 5 | 6 | 5 | 6 | 5 |
| Dependability 75% | mm/yr | 20 | 22 | 20 | 22 | 20 | 22 | 20 |
| Dependability 50% | mm/yr | 156 | 170 | 156 | 170 | 156 | 170 | 156 |
| Dependability 25% | mm/yr | 357 | 380 | 349 | 349 | 320 | 317 | 291 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 7.75 | 7.58 | 7.58 | 6.95 | 6.95 | 6.32 | 6.32 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 8.30 | 8.55 | 8.55 | 9.44 | 9.44 | 10.35 | 10.35 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 25.15 | 25.90 | 25.90 | 28.61 | 28.61 | 31.35 | 31.35 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.21 | 1.21 | 1.21 | 1.21 | 1.21 | 1.21 | 1.21 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge :ed Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 39.55 | | 39.55 | | 39.55 | | 39.55 |
| Weighted Mean | $Mm^3/yr$ | 5.63 | 5.04 | 5.54 | 4.75 | 5.21 | 4.44 | 4.88 |
| Dependability 90% | $Mm^3/yr$ | 0.18 | 0.17 | 0.18 | 0.17 | 0.18 | 0.17 | 0.18 |
| Dependability 75% | $Mm^3/yr$ | 0.70 | 0.63 | 0.70 | 0.63 | 0.70 | 0.63 | 0.70 |
| Dependability 50% | $Mm^3/yr$ | 5.35 | 4.87 | 5.35 | 4.87 | 5.35 | 4.87 | 5.35 |
| Dependability 25% | $Mm^3/yr$ | 12.27 | 10.91 | 11.99 | 10.01 | 11.00 | 9.09 | 9.99 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 5.69 | 5.04 | 5.54 | 4.75 | 5.21 | 4.44 | 4.88 |
| Dependability 90% | $Mm^3/yr$ | 0.24 | 0.17 | 0.18 | 0.17 | 0.18 | 0.17 | 0.18 |
| Dependability 75% | $Mm^3/yr$ | 0.75 | 0.63 | 0.70 | 0.63 | 0.70 | 0.63 | 0.70 |
| Dependability 50% | $Mm^3/yr$ | 5.41 | 4.87 | 5.35 | 4.87 | 5.35 | 4.87 | 5.35 |
| Dependability 25% | $Mm^3/yr$ | 12.32 | 10.91 | 11.99 | 10.01 | 11.00 | 9.09 | 9.99 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.19 | 0.19 | 0.21 | 0.21 |
| Dependability 90% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.19 | 0.19 | 0.21 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.19 | 0.19 | 0.21 | 0.21 |
| Dependability 50% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.19 | 0.19 | 0.21 | 0.21 |
| Dependability 25% | $Mm^3/yr$ | 0.09 | 0.15 | 0.15 | 0.19 | 0.19 | 0.21 | 0.21 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 5.78 | 5.20 | 5.69 | 4.93 | 5.40 | 4.65 | 5.09 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.32 | 0.34 | 0.35 | 0.37 | 0.38 | 0.39 |
| Dependability 75% | $Mm^3/yr$ | 0.85 | 0.79 | 0.85 | 0.82 | 0.88 | 0.84 | 0.91 |
| Dependability 50% | $Mm^3/yr$ | 5.50 | 5.03 | 5.51 | 5.06 | 5.54 | 5.08 | 5.56 |
| Dependability 25% | $Mm^3/yr$ | 12.42 | 11.07 | 12.14 | 10.20 | 11.18 | 9.30 | 10.20 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 5.97 | 4.75 | 5.25 | 4.18 | 4.64 | 3.74 | 4.16 |
| Dependability 90% | $Mm^3/yr$ | 0.52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 1.04 | 0.32 | 0.38 | 0.00 | 0.03 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 5.69 | 4.56 | 5.04 | 4.21 | 4.69 | 3.98 | 4.46 |
| Dependability 25% | $Mm^3/yr$ | 12.61 | 10.60 | 11.67 | 9.35 | 10.33 | 8.20 | 9.10 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 4.98 | 4.43 | 4.56 | 4.18 | 4.40 | 3.74 | 4.16 |
| Dependability 90% | $Mm^3/yr$ | 0.52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 1.04 | 0.32 | 0.38 | 0.00 | 0.03 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 5.69 | 4.56 | 5.04 | 4.21 | 4.69 | 3.98 | 4.46 |
| Dependability 25% | $Mm^3/yr$ | 9.60 | 9.60 | 9.60 | 9.35 | 9.60 | 8.20 | 9.10 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: Wtd. Mean | | mm/yr | 87 | 77 | 80 | 73 | 77 | 65 | 73 |
| | Dependability 90% | mm/yr | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dependability 75% | mm/yr | 18 | 6 | 7 | 0 | 1 | 0 | 0 |
| | Dependability 50% | mm/yr | 99 | 79 | 88 | 73 | 82 | 69 | 78 |
| | Dependability 25% | mm/yr | 167 | 167 | 167 | 163 | 167 | 143 | 159 |
| Well Yield | | $10^3 m^3/yr$ | 27 | | | | | | |
| No. of Irrigation Wells | Existing | | 354 | 354 | 354 | 354 | 354 | 354 | 354 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 9.60 | 9.60 | 9.60 | 9.60 | 9.60 | 9.60 | 9.60 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 14.38 | 14.51 | 13.81 | 13.67 | 13.10 | 12.63 | 12.31 |
| | Dependability 90% | $Mm^3/yr$ | 0.83 | 0.33 | 0.31 | 0.33 | 0.31 | 0.33 | 0.31 |
| | Dependability 75% | $Mm^3/yr$ | 2.20 | 1.59 | 1.54 | 1.27 | 1.20 | 1.27 | 1.16 |
| | Dependability 50% | $Mm^3/yr$ | 14.63 | 14.30 | 13.97 | 13.96 | 13.63 | 13.73 | 13.40 |
| | Dependability 25% | $Mm^3/yr$ | 30.07 | 31.43 | 29.61 | 29.37 | 27.95 | 26.39 | 25.78 |
| Depth | ted Mean | mm/yr | 251 | 253 | 241 | 238 | 228 | 220 | 215 |
| | Dependability 90% | mm/yr | 14 | 6 | 5 | 6 | 5 | 6 | 5 |
| | Dependability 75% | mm/yr | 38 | 28 | 27 | 22 | 21 | 22 | 20 |
| | Dependability 50% | mm/yr | 255 | 249 | 243 | 243 | 237 | 239 | 233 |
| | Dependability 25% | mm/yr | 524 | 548 | 516 | 512 | 487 | 460 | 449 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9639 | | | | | | |
| | Total | Mill.Rs. | | 55.32 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 55.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.44 | | | | | | |
| Average Annual Cost | Mill.Rs | 2.19 | 1.95 | 2.01 | 1.84 | 1.93 | 1.65 | 1.83 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 0.95 | 0.84 | 0.87 | 0.79 | 0.84 | 0.71 | 0.79 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 0.95 | 0.84 | 0.87 | 0.79 | 0.84 | 0.71 | 0.79 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.230 | 0.260 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Som Kagdar Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Mahi |
| Irrigation Demand Zone (IDZ) | Dungarpur |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.23 | 0.26 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 5739 | 5739 | 5739 | 5739 | 5739 | 5739 | 5739 |
| SW On-Farm Irrigation Efficiency | % | 65.91 | 70.00 | 65.91 | 70.00 | 65.91 | 70.00 | 65.91 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.31 | 0.33 | 0.31 | 0.33 | 0.31 | 0.33 | 0.31 |
| Dependability 75% | $Mm^3/yr$ | 1.16 | 1.27 | 1.16 | 1.27 | 1.16 | 1.27 | 1.16 |
| Dependability 50% | $Mm^3/yr$ | 8.93 | 9.75 | 8.93 | 9.75 | 8.93 | 9.75 | 8.93 |
| Dependability 25% | $Mm^3/yr$ | 20.47 | 21.83 | 20.01 | 20.02 | 18.35 | 18.19 | 16.67 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 1.04 | 0.32 | 0.38 | 0.00 | 0.03 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 5.69 | 4.56 | 5.04 | 4.21 | 4.69 | 3.98 | 4.46 |
| Dependability 25% | $Mm^3/yr$ | 12.61 | 10.60 | 11.67 | 9.35 | 10.33 | 8.20 | 9.10 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 9.60 | 9.60 | 9.60 | 9.60 | 9.60 | 9.60 | 9.60 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 | 1.92 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 40.35 | 52.43 | 47.60 | 55.61 | 49.07 | 0.00 | 50.34 |
| CMLP Irrig. Intensity Dependability 90% | % | 3.66 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | % | 9.75 | 7.40 | 6.74 | 0.00 | 1.31 | 0.00 | 0.00 |
| Dependability 50% | % | 65.29 | 68.49 | 61.28 | 67.95 | 60.85 | 0.00 | 59.85 |
| Dependability 25% | % | 130.08 | 140.88 | 128.36 | 140.18 | 122.14 | 0.00 | 113.72 |
| Weighted Mean | % | 62.80 | 66.00 | 59.84 | 63.93 | 56.43 | 0.00 | 53.09 |
| CMLP GW Use Dependability 90% | % | 63.09 | 8.40 | -134.49 | -111.83 | -134.49 | 38.98 | 40.97 |
| Dependability 75% | % | 45.36 | 17.82 | 22.29 | -6.04 | 9.18 | 5.05 | -244.40 |
| Dependability 50% | % | 32.63 | 26.26 | 30.52 | 23.25 | 27.56 | 96.11 | 26.31 |
| Dependability 25% | % | 25.40 | 26.07 | 25.87 | 23.98 | 26.34 | 72.10 | 28.27 |

## VIII. Data for Present Value Assessment

| Period | Investment | Operation | | Lngth | Start |
|---|---|---|---|---|---|
| | Completed | From | Up To | (yrs) | (yrs) |
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 6.10 | 0.00 | 6.10 | 0.00 | 6.10 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 0.95 | 6.94 | 0.87 | 6.90 | 0.84 | 6.82 | 0.79 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 6.10 | 0.00 | 6.10 | 0.00 | 6.10 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 0.95 | 6.94 | 0.87 | 6.90 | 0.84 | 6.82 | 0.79 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 40.35 | 52.43 | 47.60 | 55.61 | 49.07 | 56.28 | 50.34 |
| Wtd.Mean net Irrigation water supply | $Mm^3$/yr | 9.43 | 10.38 | 9.06 | 9.78 | 8.59 | 9.03 | 8.08 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3$/yr | 14.38 | 14.51 | 13.81 | 13.67 | 13.10 | 12.63 | 12.31 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3$/yr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 88.23 | 84.13 | 4.10 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 88.23 | 84.13 | 4.10 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 328.59 | 296.37 | 32.22 |
| 5. Total Project Costs | Mill.Rs. | | 42.81 | 5.30 | 37.51 |
| 6. Project Capital Costs | Mill.Rs. | | 37.70 | 0.00 | 37.70 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 42.81 | 5.30 | 37.51 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 37.70 | 0.00 | 37.70 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 285.79 | 291.07 | -5.28 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.49 | 0.06 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6569 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.88 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.86** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Tordi Sagar Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | TONK | Name(s): | |
| Groundwater Potential Zone (PZ) | MALPURA,TODARAISING | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 704.88 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 35.85 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.43 | 0.85 | 0.85 | 1.02 | 1.02 | 1.12 | 1.12 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.31 | 0.33 | 0.33 | 0.38 | 0.38 | 0.42 | 0.42 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 13,954 | 13,391 | 13,954 | 13,391 | 13,954 | 13,391 | 13,954 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 8.39 | | | | | | |
| 2010 Irrigated Area | | ha | | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 51.32 | 51.32 | 51.32 | 51.32 | 51.32 | 51.32 | 51.32 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| | Dependability 50% | $Mm^3/yr$ | 9.20 | 9.20 | 9.20 | 9.20 | 9.20 | 9.20 | 9.20 |
| | Dependability 25% | $Mm^3/yr$ | 81.60 | 81.60 | 81.60 | 81.60 | 81.60 | 81.60 | 81.60 |
| | Weighted Mean | $Mm^3/yr$ | 25.49 | 25.49 | 25.49 | 25.49 | 25.49 | 25.49 | 25.49 |
| Losses from Reservoir | Annual | % | 24.82 | | | | | | |
| | During the Rabi Season | % | 10.93 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.09 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.92 | 0.92 | 2.77 | 2.77 | 4.62 | 4.62 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 35.85 | 34.93 | 34.93 | 33.08 | 33.08 | 31.23 | 31.23 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 11.30 | 11.07 | 11.07 | 10.61 | 10.61 | 10.15 | 10.15 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| Dependability 50% | $Mm^3/yr$ | 8.19 | 8.19 | 8.19 | 8.19 | 8.19 | 8.19 | 8.19 |
| Dependability 25% | $Mm^3/yr$ | 31.93 | 31.11 | 31.11 | 29.46 | 29.46 | 27.82 | 27.82 |
| On-Farm Irrigation Efficiency | % | 59.00 | 70.00 | 59.00 | 70.00 | 59.00 | 70.00 | 59.00 |
| Off-Farm Irrigation Efficiency | % | 48.19 | 72.00 | 48.19 | 72.00 | 48.19 | 72.00 | 48.19 |
| Present Overall Irrigation Efficiency | % | 28.43 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 5.44 | 7.97 | 5.33 | 7.64 | 5.11 | 7.30 | 4.89 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 |
| Dependability 50% | $Mm^3/yr$ | 3.95 | 5.90 | 3.95 | 5.90 | 3.95 | 5.90 | 3.95 |
| Dependability 25% | $Mm^3/yr$ | 15.39 | 22.40 | 14.99 | 21.21 | 14.20 | 20.03 | 13.41 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 39 | 60 | 38 | 57 | 37 | 55 | 35 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Dependability 50% | mm/yr | 28 | 44 | 28 | 44 | 28 | 44 | 28 |
| Dependability 25% | mm/yr | 110 | 167 | 107 | 158 | 102 | 150 | 96 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 7.98 | 7.78 | 7.78 | 7.37 | 7.37 | 6.95 | 6.95 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 12.81 | 13.07 | 13.07 | 13.59 | 13.59 | 14.10 | 14.10 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 45.75 | 46.67 | 46.67 | 48.52 | 48.52 | 50.37 | 50.37 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 5.93 | 5.93 | 5.93 | 5.93 | 5.93 | 5.93 | 5.93 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 50.10 | | 50.10 | | 50.10 | | 50.10 |
| Weighted Mean | $Mm^3/yr$ | 5.66 | 3.98 | 5.54 | 3.82 | 5.31 | 3.65 | 5.08 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.13 | 0.10 | 0.13 | 0.10 | 0.13 | 0.10 | 0.13 |
| Dependability 50% | $Mm^3/yr$ | 4.11 | 2.95 | 4.11 | 2.95 | 4.11 | 2.95 | 4.11 |
| Dependability 25% | $Mm^3/yr$ | 16.00 | 11.20 | 15.59 | 10.61 | 14.76 | 10.01 | 13.94 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 1.56 | 0.95 | 1.43 | 0.91 | 1.36 | 0.88 | 1.32 |
| Dependability 90% | $Mm^3/yr$ | 1.56 | 0.95 | 1.43 | 0.91 | 1.36 | 0.88 | 1.32 |
| Dependability 75% | $Mm^3/yr$ | 1.56 | 0.95 | 1.43 | 0.91 | 1.36 | 0.88 | 1.32 |
| Dependability 50% | $Mm^3/yr$ | 1.56 | 0.95 | 1.43 | 0.91 | 1.36 | 0.88 | 1.32 |
| Dependability 25% | $Mm^3/yr$ | 1.56 | 0.95 | 1.43 | 0.91 | 1.36 | 0.88 | 1.32 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 7.22 | 4.93 | 6.97 | 4.72 | 6.67 | 4.53 | 6.40 |
| Dependability 90% | $Mm^3/yr$ | 1.56 | 0.95 | 1.43 | 0.91 | 1.36 | 0.88 | 1.32 |
| Dependability 75% | $Mm^3/yr$ | 1.69 | 1.05 | 1.56 | 1.00 | 1.49 | 0.97 | 1.45 |
| Dependability 50% | $Mm^3/yr$ | 5.66 | 3.90 | 5.53 | 3.86 | 5.46 | 3.83 | 5.42 |
| Dependability 25% | $Mm^3/yr$ | 17.55 | 12.15 | 17.01 | 11.51 | 16.12 | 10.89 | 15.25 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.07 | 0.11 | 0.11 | 0.13 | 0.13 | 0.14 | 0.14 |
| Dependability 90% | $Mm^3/yr$ | 0.07 | 0.11 | 0.11 | 0.13 | 0.13 | 0.14 | 0.14 |
| Dependability 75% | $Mm^3/yr$ | 0.07 | 0.11 | 0.11 | 0.13 | 0.13 | 0.14 | 0.14 |
| Dependability 50% | $Mm^3/yr$ | 0.07 | 0.11 | 0.11 | 0.13 | 0.13 | 0.14 | 0.14 |
| Dependability 25% | $Mm^3/yr$ | 0.07 | 0.11 | 0.11 | 0.13 | 0.13 | 0.14 | 0.14 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 7.28 | 5.04 | 7.08 | 4.85 | 6.80 | 4.67 | 6.54 |
| Dependability 90% | $Mm^3/yr$ | 1.62 | 1.06 | 1.53 | 1.03 | 1.49 | 1.02 | 1.46 |
| Dependability 75% | $Mm^3/yr$ | 1.76 | 1.15 | 1.67 | 1.13 | 1.62 | 1.11 | 1.59 |
| Dependability 50% | $Mm^3/yr$ | 5.73 | 4.01 | 5.64 | 3.98 | 5.59 | 3.97 | 5.56 |
| Dependability 25% | $Mm^3/yr$ | 17.62 | 12.26 | 17.12 | 11.64 | 16.25 | 11.03 | 15.39 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 12.47 | 9.79 | 11.83 | 9.38 | 11.33 | 9.06 | 10.93 |
| Dependability 90% | $Mm^3/yr$ | 6.81 | 5.81 | 6.28 | 5.56 | 6.02 | 5.41 | 5.85 |
| Dependability 75% | $Mm^3/yr$ | 6.95 | 5.90 | 6.42 | 5.66 | 6.15 | 5.50 | 5.98 |
| Dependability 50% | $Mm^3/yr$ | 10.92 | 8.76 | 10.39 | 8.51 | 10.12 | 8.36 | 9.95 |
| Dependability 25% | $Mm^3/yr$ | 22.81 | 17.01 | 21.87 | 16.17 | 20.78 | 15.42 | 19.78 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 12.47 | 9.79 | 11.83 | 9.38 | 11.33 | 9.06 | 10.93 |
| Dependability 90% | $Mm^3/yr$ | 6.81 | 5.81 | 6.28 | 5.56 | 6.02 | 5.41 | 5.85 |
| Dependability 75% | $Mm^3/yr$ | 6.95 | 5.90 | 6.42 | 5.66 | 6.15 | 5.50 | 5.98 |
| Dependability 50% | $Mm^3/yr$ | 10.92 | 8.76 | 10.39 | 8.51 | 10.12 | 8.36 | 9.95 |
| Dependability 25% | $Mm^3/yr$ | 22.81 | 17.01 | 21.87 | 16.17 | 20.78 | 15.42 | 19.78 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 89 | 73 | 85 | 70 | 81 | 68 | 78 |
| | Dependability 90% | mm/yr | 49 | 43 | 45 | 42 | 43 | 40 | 42 |
| | Dependability 75% | mm/yr | 50 | 44 | 46 | 42 | 44 | 41 | 43 |
| | Dependability 50% | mm/yr | 78 | 65 | 74 | 64 | 73 | 62 | 71 |
| | Dependability 25% | mm/yr | 163 | 127 | 157 | 121 | 149 | 115 | 142 |
| Well Yield | | $10^3 m^3/yr$ | 29 | | | | | | |
| No. of Irrigation Wells | Existing | | 840 | 840 | 840 | 840 | 840 | 840 | 840 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 24.37 | 24.37 | 24.37 | 24.37 | 24.37 | 24.37 | 24.37 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 4.87 | 4.87 | 4.87 | 4.87 | 4.87 | 4.87 | 4.87 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 17.92 | 17.76 | 17.16 | 17.02 | 16.44 | 16.36 | 15.82 |
| | Dependability 90% | $Mm^3/yr$ | 6.81 | 5.81 | 6.28 | 5.56 | 6.02 | 5.41 | 5.85 |
| | Dependability 75% | $Mm^3/yr$ | 7.08 | 6.10 | 6.54 | 5.85 | 6.28 | 5.70 | 6.11 |
| | Dependability 50% | $Mm^3/yr$ | 14.87 | 14.66 | 14.34 | 14.41 | 14.07 | 14.26 | 13.90 |
| | Dependability 25% | $Mm^3/yr$ | 38.20 | 39.41 | 36.86 | 37.38 | 34.98 | 35.45 | 33.19 |
| Depth | ted Mean | mm/yr | 128 | 133 | 123 | 127 | 118 | 122 | 113 |
| | Dependability 90% | mm/yr | 49 | 43 | 45 | 42 | 43 | 40 | 42 |
| | Dependability 75% | mm/yr | 51 | 46 | 47 | 44 | 45 | 43 | 44 |
| | Dependability 50% | mm/yr | 107 | 109 | 103 | 108 | 101 | 106 | 100 |
| | Dependability 25% | mm/yr | 274 | 294 | 264 | 279 | 251 | 265 | 238 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 14370 | | | | | | |
| | Total | Mill.Rs. | | 192.43 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 192.43 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.52 | | | | | | |
| Average Annual Cost | Mill.Rs | 6.49 | 5.09 | 6.15 | 4.88 | 5.89 | 4.71 | 5.68 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 6.49 | 5.09 | 6.15 | 4.88 | 5.89 | 4.71 | 5.68 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 6.49 | 5.09 | 6.15 | 4.88 | 5.89 | 4.71 | 5.68 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.210 | 0.230 | 0.280 | 0.280 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Tordi Sagar Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | TONK |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.21 | 0.23 | 0.28 | 0.28 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 13954 | 13391 | 13954 | 13391 | 13954 | 13391 | 13954 |
| SW On-Farm Irrigation Efficiency | % | 59.00 | 70.00 | 59.00 | 70.00 | 59.00 | 70.00 | 59.00 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 | 0.19 | 0.13 |
| Dependability 50% | $Mm^3/yr$ | 3.95 | 5.90 | 3.95 | 5.90 | 3.95 | 5.90 | 3.95 |
| Dependability 25% | $Mm^3/yr$ | 15.39 | 22.40 | 14.99 | 21.21 | 14.20 | 20.03 | 13.41 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 6.81 | 5.81 | 6.28 | 5.56 | 6.02 | 5.41 | 5.85 |
| Dependability 75% | $Mm^3/yr$ | 6.95 | 5.90 | 6.42 | 5.66 | 6.15 | 5.50 | 5.98 |
| Dependability 50% | $Mm^3/yr$ | 10.92 | 8.76 | 10.39 | 8.51 | 10.12 | 8.36 | 9.95 |
| Dependability 25% | $Mm^3/yr$ | 22.81 | 17.01 | 21.87 | 16.17 | 20.78 | 15.42 | 19.78 |
| Firm GW for Kharif | $Mm^3/yr$ | 6.81 | 5.81 | 6.28 | 5.56 | 6.02 | 5.41 | 5.85 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 24.37 | 24.37 | 24.37 | 24.37 | 24.37 | 24.37 | 24.37 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 4.87 | 4.87 | 4.87 | 4.87 | 4.87 | 4.87 | 4.87 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 92.18 | 101.98 | 85.49 | 110.44 | 92.56 | 119.64 | 100.33 |
| CMLP Irrig. Intensity Dependability 90% | % | 10.50 | 10.76 | 9.68 | 9.70 | 8.72 | 9.43 | 8.48 |
| Dependability 75% | % | 10.92 | 11.30 | 10.10 | 10.21 | 9.11 | 9.93 | 8.86 |
| Dependability 50% | % | 22.54 | 26.66 | 21.72 | 24.64 | 20.04 | 24.37 | 19.79 |
| Dependability 25% | % | 57.44 | 71.19 | 55.40 | 63.47 | 49.40 | 60.20 | 46.89 |
| Weighted Mean | % | 27.11 | 32.26 | 25.95 | 29.06 | 23.37 | 27.94 | 22.49 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Dependability 75% | % | 98.14 | 96.77 | 97.99 | 96.64 | 97.90 | 96.55 | 97.84 |
| Dependability 50% | % | 72.45 | 57.82 | 70.61 | 57.22 | 70.91 | 56.74 | 70.55 |
| Dependability 25% | % | 57.43 | 39.52 | 57.00 | 39.86 | 57.24 | 40.12 | 57.46 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 21.23 | 0.00 | 21.23 | 0.00 | 21.23 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 6.49 | 26.32 | 6.15 | 26.11 | 5.89 | 25.94 | 5.68 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 21.23 | 0.00 | 21.23 | 0.00 | 21.23 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 6.49 | 26.32 | 6.15 | 26.11 | 5.89 | 25.94 | 5.68 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 92.18 | 101.98 | 85.49 | 110.44 | 92.56 | 119.64 | 100.33 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 11.32 | 12.92 | 10.83 | 12.38 | 10.38 | 11.91 | 9.99 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 17.92 | 17.76 | 17.16 | 17.02 | 16.44 | 16.36 | 15.82 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 108.49 | 104.82 | 3.66 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 108.49 | 104.82 | 3.66 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 643.91 | 539.75 | 104.16 |
| 5. Total Project Costs | Mill.Rs. | | 162.25 | 37.57 | 124.68 |
| 6. Project Capital Costs | Mill.Rs. | | 131.14 | 0.00 | 131.14 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 162.25 | 37.57 | 124.68 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 131.14 | 0.00 | 131.14 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 481.66 | 502.18 | -20.52 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.50 | 0.36 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 9793 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.87 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.84** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Udai Sagar Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Udaipur | Name(s): | |
| Groundwater Potential Zone (PZ) | Bhindar,Girwa | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 196 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 26.94 | Code: | |
| Present Dead Storage, $Mm^3$ | 3.01 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | 0.24 | 0.28 | 0.28 | 0.36 | 0.36 | 0.43 | 0.43 |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.27 | 0.57 | 0.57 | 0.73 | 0.73 | 0.83 | 0.83 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 5.100 | 5.100 | 5.100 | 5.100 | 5.100 | 5.100 | 5.100 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.19 | 0.20 | 0.20 | 0.22 | 0.22 | 0.25 | 0.25 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 4,650 | 4,650 | 4,650 | 4,650 | 4,650 | 4,650 | 4,650 |
| 2006rrigation (Gross) | | $Mm^3/yr$ | 23.77 | | | | | | |
| 2006 Irrigated Area | | ha | 3605 | | | | | | |

### III. Water Sources

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 26.40 | 26.40 | 26.40 | 26.40 | 26.40 | 26.40 | 26.40 |
| | Dependability 90% | $Mm^3/yr$ | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| | Dependability 75% | $Mm^3/yr$ | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 |
| | Dependability 50% | $Mm^3/yr$ | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 |
| | Dependability 25% | $Mm^3/yr$ | 16.60 | 16.60 | 16.60 | 16.60 | 16.60 | 16.60 | 16.60 |
| | Weighted Mean | $Mm^3/yr$ | 7.98 | 7.98 | 7.98 | 7.98 | 7.98 | 7.98 | 7.98 |
| Losses from Reservoir | Annual | % | 14.29 | | | | | | |
| | During the Rabi Season | % | 6.87 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.03 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.26 | 0.26 | 0.77 | 0.77 | 1.28 | 1.28 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 26.94 | 26.80 | 26.80 | 26.52 | 26.52 | 26.23 | 26.23 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Dependability 25% | $Mm^3/yr$ | 9.92 | 9.92 | 9.92 | 9.92 | 9.92 | 9.92 | 9.92 |
| On-Farm Irrigation Efficiency | % | 57.02 | 70.00 | 57.02 | 70.00 | 57.02 | 70.00 | 57.02 |
| Off-Farm Irrigation Efficiency | % | 28.22 | 72.00 | 28.22 | 72.00 | 28.22 | 72.00 | 28.22 |
| Present Overall Irrigation Efficiency | % | 16.09 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 0.99 | 2.52 | 0.99 | 2.52 | 0.99 | 2.52 | 0.99 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.25 | 0.64 | 0.25 | 0.64 | 0.25 | 0.64 | 0.25 |
| Dependability 25% | $Mm^3/yr$ | 2.80 | 7.14 | 2.80 | 7.14 | 2.80 | 7.14 | 2.80 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 21 | 54 | 21 | 54 | 21 | 54 | 21 |
| Dependability 90% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 75% | mm/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependability 50% | mm/yr | 5 | 14 | 5 | 14 | 5 | 14 | 5 |
| Dependability 25% | mm/yr | 60 | 154 | 60 | 154 | 60 | 154 | 60 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.48 | 2.48 | 2.48 | 2.48 | 2.48 | 2.48 | 2.48 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 3.62 | 3.62 | 3.62 | 3.62 | 3.62 | 3.62 | 3.62 |
| Dependability 90% | $Mm^3/yr$ | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| Dependability 75% | $Mm^3/yr$ | 2.23 | 2.23 | 2.23 | 2.23 | 2.23 | 2.23 | 2.23 |
| Dependability 50% | $Mm^3/yr$ | 5.10 | 5.10 | 5.10 | 5.10 | 5.10 | 5.10 | 5.10 |
| Dependability 25% | $Mm^3/yr$ | 5.10 | 5.10 | 5.10 | 5.10 | 5.10 | 5.10 | 5.10 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.21 | 1.21 | 1.21 | 1.21 | 1.21 | 1.21 | 1.21 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 58.74 | | 58.74 | | 58.74 | | 58.74 |
| Weighted Mean | $Mm^3/yr$ | 2.06 | 1.26 | 2.06 | 1.26 | 2.06 | 1.26 | 2.06 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.52 | 0.32 | 0.52 | 0.32 | 0.52 | 0.32 | 0.52 |
| Dependability 25% | $Mm^3/yr$ | 5.83 | 3.57 | 5.83 | 3.57 | 5.83 | 3.57 | 5.83 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.15 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.15 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.15 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.15 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.15 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 2.21 | 1.29 | 2.11 | 1.26 | 2.06 | 1.26 | 2.06 |
| Dependability 90% | $Mm^3/yr$ | 0.15 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.15 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.67 | 0.35 | 0.57 | 0.32 | 0.52 | 0.32 | 0.52 |
| Dependability 25% | $Mm^3/yr$ | 5.98 | 3.60 | 5.87 | 3.57 | 5.83 | 3.57 | 5.83 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.10 | 0.13 | 0.13 | 0.16 | 0.16 | 0.17 | 0.17 |
| Dependability 90% | $Mm^3/yr$ | 0.10 | 0.13 | 0.13 | 0.16 | 0.16 | 0.17 | 0.17 |
| Dependability 75% | $Mm^3/yr$ | 0.10 | 0.13 | 0.13 | 0.16 | 0.16 | 0.17 | 0.17 |
| Dependability 50% | $Mm^3/yr$ | 0.10 | 0.13 | 0.13 | 0.16 | 0.16 | 0.17 | 0.17 |
| Dependability 25% | $Mm^3/yr$ | 0.10 | 0.13 | 0.13 | 0.16 | 0.16 | 0.17 | 0.17 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 2.31 | 1.42 | 2.24 | 1.42 | 2.21 | 1.43 | 2.23 |
| Dependability 90% | $Mm^3/yr$ | 0.25 | 0.16 | 0.18 | 0.16 | 0.16 | 0.17 | 0.17 |
| Dependability 75% | $Mm^3/yr$ | 0.25 | 0.16 | 0.18 | 0.16 | 0.16 | 0.17 | 0.17 |
| Dependability 50% | $Mm^3/yr$ | 0.77 | 0.48 | 0.70 | 0.47 | 0.68 | 0.49 | 0.69 |
| Dependability 25% | $Mm^3/yr$ | 6.08 | 3.73 | 6.00 | 3.73 | 5.98 | 3.74 | 6.00 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 2.82 | 1.58 | 2.40 | 1.32 | 2.11 | 1.19 | 1.98 |
| Dependability 90% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 1.28 | 0.64 | 0.86 | 0.38 | 0.58 | 0.19 | 0.39 |
| Dependability 25% | $Mm^3/yr$ | 6.59 | 3.89 | 6.16 | 3.63 | 5.88 | 3.44 | 5.70 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 2.82 | 1.58 | 2.40 | 1.32 | 2.11 | 1.19 | 1.98 |
| Dependability 90% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 1.28 | 0.64 | 0.86 | 0.38 | 0.58 | 0.19 | 0.39 |
| Dependability 25% | $Mm^3/yr$ | 6.59 | 3.89 | 6.16 | 3.63 | 5.88 | 3.44 | 5.70 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 61 | 34 | 52 | 28 | 45 | 25 | 43 |
| | Dependability 90% | mm/yr | 16 | 7 | 7 | 1 | 1 | 0 | 0 |
| | Dependability 75% | mm/yr | 16 | 7 | 7 | 1 | 1 | 0 | 0 |
| | Dependability 50% | mm/yr | 28 | 14 | 18 | 8 | 12 | 4 | 8 |
| | Dependability 25% | mm/yr | 142 | 84 | 133 | 78 | 126 | 74 | 122 |
| Well Yield | | $10^3 m^3/yr$ | 9 | | | | | | |
| No. of Irrigation Wells | Existing | | 906 | 906 | 906 | 906 | 906 | 906 | 906 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 8.59 | 8.59 | 8.59 | 8.59 | 8.59 | 8.59 | 8.59 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 3.81 | 4.10 | 3.39 | 3.84 | 3.10 | 3.71 | 2.97 |
| | Dependability 90% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 1.53 | 1.28 | 1.11 | 1.01 | 0.83 | 0.83 | 0.64 |
| | Dependability 25% | $Mm^3/yr$ | 9.38 | 11.03 | 8.96 | 10.77 | 8.68 | 10.58 | 8.49 |
| Depth | ted Mean | mm/yr | 82 | 88 | 73 | 83 | 67 | 80 | 64 |
| | Dependability 90% | mm/yr | 16 | 7 | 7 | 1 | 1 | 0 | 0 |
| | Dependability 75% | mm/yr | 16 | 7 | 7 | 1 | 1 | 0 | 0 |
| | Dependability 50% | mm/yr | 33 | 27 | 24 | 22 | 18 | 18 | 14 |
| | Dependability 25% | mm/yr | 202 | 237 | 193 | 232 | 187 | 228 | 183 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.01 | 0.04 | 0.04 | 0.10 | 0.10 | 0.22 | 0.22 |
| | Annual Irrigation Depth | mm | 0.20 | 0.95 | 0.94 | 2.17 | 2.19 | 4.63 | 4.62 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 16744 | | | | | | |
| | Total | Mill.Rs. | | 77.86 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 77.86 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.50 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.41 | 0.79 | 1.20 | 0.66 | 1.06 | 0.59 | 0.99 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.41 | 0.79 | 1.20 | 0.66 | 1.06 | 0.59 | 0.99 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 1.41 | 0.79 | 1.20 | 0.66 | 1.06 | 0.59 | 0.99 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.210 | 0.200 | 0.260 | 0.330 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Udai Sagar Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Udaipur |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.21 | 0.2 | 0.26 | 0.33 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 4650 | 4650 | 4650 | 4650 | 4650 | 4650 | 4650 |
| SW On-Farm Irrigation Efficiency | % | 57.02 | 70.00 | 57.02 | 70.00 | 57.02 | 70.00 | 57.02 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.25 | 0.64 | 0.25 | 0.64 | 0.25 | 0.64 | 0.25 |
| Dependability 25% | $Mm^3/yr$ | 2.80 | 7.14 | 2.80 | 7.14 | 2.80 | 7.14 | 2.80 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 1.28 | 0.64 | 0.86 | 0.38 | 0.58 | 0.19 | 0.39 |
| Dependability 25% | $Mm^3/yr$ | 6.59 | 3.89 | 6.16 | 3.63 | 5.88 | 3.44 | 5.70 |
| Firm GW for Kharif | $Mm^3/yr$ | 0.76 | 0.32 | 0.34 | 0.06 | 0.06 | 0.00 | 0.00 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 8.59 | 8.59 | 8.59 | 8.59 | 8.59 | 8.59 | 8.59 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 | 1.72 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 18.84 | 22.20 | 15.96 | 23.48 | 16.51 | 0.00 | 18.17 |
| CMLP Irrig. Intensity Dependability 90% | % | 3.82 | 1.86 | 1.71 | 0.33 | 0.27 | 0.00 | 0.00 |
| Dependability 75% | % | 3.83 | 1.86 | 1.71 | 0.33 | 0.27 | 0.00 | 0.00 |
| Dependability 50% | % | 7.58 | 7.20 | 5.45 | 5.45 | 3.86 | 0.00 | 2.88 |
| Dependability 25% | % | 45.89 | 61.82 | 43.75 | 57.85 | 41.07 | 0.00 | 38.63 |
| Weighted Mean | % | 18.68 | 23.03 | 16.56 | 20.64 | 14.67 | 0.00 | 13.50 |
| CMLP GW Use Dependability 90% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | #DIV/0! | #DIV/0! |
| Dependability 75% | % | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 62.19 |
| Dependability 50% | % | 83.15 | 45.07 | 76.14 | 30.87 | 67.51 | 92.69 | 58.67 |
| Dependability 25% | % | 67.35 | 26.82 | 65.73 | 25.42 | 64.66 | 73.06 | 65.00 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 8.59 | 0.00 | 8.59 | 0.00 | 8.59 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 1.41 | 9.38 | 1.20 | 9.25 | 1.06 | 9.18 | 0.99 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 8.59 | 0.00 | 8.59 | 0.00 | 8.59 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 1.41 | 9.38 | 1.20 | 9.25 | 1.06 | 9.18 | 0.99 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 18.84 | 22.20 | 15.96 | 23.48 | 16.51 | 0.00 | 18.17 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 2.40 | 2.95 | 2.12 | 2.76 | 1.94 | 2.65 | 1.85 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 3.81 | 4.10 | 3.39 | 3.84 | 3.10 | 3.71 | 2.97 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 3.62 | 3.62 | 3.62 | 3.62 | 3.62 | 3.62 | 3.62 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 47.27 | 42.81 | 4.46 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 24.94 | 20.47 | 4.46 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 22.34 | 22.34 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 134.57 | 99.68 | 34.88 |
| 5. Total Project Costs | Mill.Rs. | | 57.74 | 7.18 | 50.56 |
| 6. Project Capital Costs | Mill.Rs. | | 53.06 | 0.00 | 53.06 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 57.74 | 7.18 | 50.56 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 53.06 | 0.00 | 53.06 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 76.83 | 92.50 | -15.67 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.22 | 0.17 | |
| 2. Priority Sectors Use | % | | 47.25 | 52.18 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 11411 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 0.73 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **0.70** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

# Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Ummed Sagar Irrigation Project**

## I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | BHILWARA | Name(s): | |
| Groundwater Potential Zone (PZ) | SHAHPURA | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 174 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 15.65 | Code: | |
| Present Dead Storage, $Mm^3$ | 0 | Name: | |

## II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.14 | 0.28 | 0.28 | 0.34 | 0.34 | 0.38 | 0.38 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.12 | 0.13 | 0.13 | 0.14 | 0.14 | 0.14 | 0.14 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 3,400 | 3,400 | 3,400 | 3,400 | 3,400 | 3,400 | 3,400 |
| 2010 Irrigation (Gross) | | $Mm^3/yr$ | 12.87 | | | | | | |
| 2010 Irrigated Area | | ha | 2729 | | | | | | |

## III. Water Sources

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 26.20 | 26.20 | 26.20 | 26.20 | 26.20 | 26.20 | 26.20 |
| | Dependability 90% | $Mm^3/yr$ | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| | Dependability 75% | $Mm^3/yr$ | 6.10 | 6.10 | 6.10 | 6.10 | 6.10 | 6.10 | 6.10 |
| | Dependability 50% | $Mm^3/yr$ | 15.30 | 15.30 | 15.30 | 15.30 | 15.30 | 15.30 | 15.30 |
| | Dependability 25% | $Mm^3/yr$ | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 |
| | Weighted Mean | $Mm^3/yr$ | 17.71 | 17.71 | 17.71 | 17.71 | 17.71 | 17.71 | 17.71 |
| Losses from Reservoir | Annual | % | 14.85 | | | | | | |
| | During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.02 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.23 | 0.23 | 0.68 | 0.68 | 1.14 | 1.14 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 15.65 | 15.42 | 15.42 | 14.97 | 14.97 | 14.51 | 14.51 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 9.48 | 9.42 | 9.42 | 9.21 | 9.21 | 8.97 | 8.97 |
| Dependability 90% | $Mm^3/yr$ | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| Dependability 75% | $Mm^3/yr$ | 5.66 | 5.66 | 5.66 | 5.66 | 5.66 | 5.66 | 5.66 |
| Dependability 50% | $Mm^3/yr$ | 14.19 | 14.19 | 14.19 | 13.88 | 13.88 | 13.46 | 13.46 |
| Dependability 25% | $Mm^3/yr$ | 14.51 | 14.30 | 14.30 | 13.88 | 13.88 | 13.46 | 13.46 |
| On-Farm Irrigation Efficiency | % | 78.43 | 78.43 | 78.43 | 78.43 | 78.43 | 78.43 | 78.43 |
| Off-Farm Irrigation Efficiency | % | 51.00 | 72.00 | 51.00 | 72.00 | 51.00 | 72.00 | 51.00 |
| Present Overall Irrigation Efficiency | % | 40.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 4.84 | 6.78 | 4.80 | 6.63 | 4.70 | 6.46 | 4.58 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.47 | 0.33 | 0.47 | 0.33 | 0.47 | 0.33 |
| Dependability 75% | $Mm^3/yr$ | 2.89 | 4.07 | 2.89 | 4.07 | 2.89 | 4.07 | 2.89 |
| Dependability 50% | $Mm^3/yr$ | 7.24 | 10.22 | 7.24 | 9.99 | 7.08 | 9.69 | 6.86 |
| Dependability 25% | $Mm^3/yr$ | 7.40 | 10.30 | 7.29 | 9.99 | 7.08 | 9.69 | 6.86 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 142 | 199 | 141 | 195 | 138 | 190 | 135 |
| Dependability 90% | mm/yr | 10 | 14 | 10 | 14 | 10 | 14 | 10 |
| Dependability 75% | mm/yr | 85 | 120 | 85 | 120 | 85 | 120 | 85 |
| Dependability 50% | mm/yr | 213 | 300 | 213 | 294 | 208 | 285 | 202 |
| Dependability 25% | mm/yr | 218 | 303 | 215 | 294 | 208 | 285 | 202 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 3.63 | 3.58 | 3.58 | 3.47 | 3.47 | 3.36 | 3.36 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 7.49 | 7.56 | 7.56 | 7.78 | 7.78 | 8.04 | 8.04 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.33 | 0.33 | 0.79 | 0.79 |
| Dependability 25% | $Mm^3/yr$ | 24.15 | 24.38 | 24.38 | 24.83 | 24.83 | 25.29 | 25.29 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 16.60 | | 16.60 | | 16.60 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 42.00 | | 42.00 | | 42.00 | | 42.00 |
| Weighted Mean | $Mm^3/yr$ | 3.98 | 2.82 | 3.96 | 2.76 | 3.87 | 2.69 | 3.77 |
| Dependability 90% | $Mm^3/yr$ | 0.27 | 0.19 | 0.27 | 0.19 | 0.27 | 0.19 | 0.27 |
| Dependability 75% | $Mm^3/yr$ | 2.38 | 1.69 | 2.38 | 1.69 | 2.38 | 1.69 | 2.38 |
| Dependability 50% | $Mm^3/yr$ | 5.96 | 4.25 | 5.96 | 4.16 | 5.83 | 4.03 | 5.65 |
| Dependability 25% | $Mm^3/yr$ | 6.10 | 4.28 | 6.01 | 4.16 | 5.83 | 4.03 | 5.65 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.29 | 0.16 | 0.24 | 0.15 | 0.23 | 0.14 | 0.21 |
| Dependability 90% | $Mm^3/yr$ | 0.29 | 0.16 | 0.24 | 0.15 | 0.23 | 0.14 | 0.21 |
| Dependability 75% | $Mm^3/yr$ | 0.29 | 0.16 | 0.24 | 0.15 | 0.23 | 0.14 | 0.21 |
| Dependability 50% | $Mm^3/yr$ | 0.29 | 0.16 | 0.24 | 0.15 | 0.23 | 0.14 | 0.21 |
| Dependability 25% | $Mm^3/yr$ | 0.29 | 0.16 | 0.24 | 0.15 | 0.23 | 0.14 | 0.21 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 4.27 | 2.98 | 4.20 | 2.91 | 4.09 | 2.83 | 3.98 |
| Dependability 90% | $Mm^3/yr$ | 0.56 | 0.36 | 0.52 | 0.34 | 0.50 | 0.34 | 0.49 |
| Dependability 75% | $Mm^3/yr$ | 2.67 | 1.86 | 2.62 | 1.84 | 2.60 | 1.84 | 2.59 |
| Dependability 50% | $Mm^3/yr$ | 6.25 | 4.41 | 6.20 | 4.31 | 6.05 | 4.17 | 5.86 |
| Dependability 25% | $Mm^3/yr$ | 6.39 | 4.45 | 6.25 | 4.31 | 6.05 | 4.17 | 5.86 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 90% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 50% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Dependability 25% | $Mm^3/yr$ | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 4.30 | 3.02 | 4.24 | 2.95 | 4.14 | 2.88 | 4.03 |
| Dependability 90% | $Mm^3/yr$ | 0.59 | 0.40 | 0.55 | 0.39 | 0.54 | 0.38 | 0.53 |
| Dependability 75% | $Mm^3/yr$ | 2.69 | 1.90 | 2.66 | 1.89 | 2.64 | 1.88 | 2.64 |
| Dependability 50% | $Mm^3/yr$ | 6.27 | 4.45 | 6.24 | 4.35 | 6.10 | 4.22 | 5.91 |
| Dependability 25% | $Mm^3/yr$ | 6.41 | 4.48 | 6.29 | 4.35 | 6.10 | 4.22 | 5.91 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 5.27 | 3.84 | 5.05 | 3.70 | 4.89 | 3.59 | 4.74 |
| Dependability 90% | $Mm^3/yr$ | 1.56 | 1.21 | 1.37 | 1.14 | 1.29 | 1.09 | 1.24 |
| Dependability 75% | $Mm^3/yr$ | 3.66 | 2.71 | 3.47 | 2.64 | 3.39 | 2.59 | 3.35 |
| Dependability 50% | $Mm^3/yr$ | 7.24 | 5.27 | 7.06 | 5.10 | 6.85 | 4.93 | 6.62 |
| Dependability 25% | $Mm^3/yr$ | 7.38 | 5.30 | 7.10 | 5.10 | 6.85 | 4.93 | 6.62 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 5.27 | 3.84 | 5.05 | 3.70 | 4.89 | 3.59 | 4.74 |
| Dependability 90% | $Mm^3/yr$ | 1.56 | 1.21 | 1.37 | 1.14 | 1.29 | 1.09 | 1.24 |
| Dependability 75% | $Mm^3/yr$ | 3.66 | 2.71 | 3.47 | 2.64 | 3.39 | 2.59 | 3.35 |
| Dependability 50% | $Mm^3/yr$ | 7.24 | 5.27 | 7.06 | 5.10 | 6.85 | 4.93 | 6.62 |
| Dependability 25% | $Mm^3/yr$ | 7.38 | 5.30 | 7.10 | 5.10 | 6.85 | 4.93 | 6.62 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 155 | 113 | 149 | 109 | 144 | 105 | 139 |
| | Dependability 90% | mm/yr | 46 | 36 | 40 | 33 | 38 | 32 | 37 |
| | Dependability 75% | mm/yr | 108 | 80 | 102 | 78 | 100 | 76 | 98 |
| | Dependability 50% | mm/yr | 213 | 155 | 208 | 150 | 201 | 145 | 195 |
| | Dependability 25% | mm/yr | 217 | 156 | 209 | 150 | 201 | 145 | 195 |
| Well Yield | | $10^3 m^3/yr$ | 43 | | | | | | |
| No. of Irrigation Wells | Existing | | 228 | 228 | 228 | 228 | 228 | 228 | 228 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 9.84 | 9.84 | 9.84 | 9.84 | 9.84 | 9.84 | 9.84 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.97 | 1.97 | 1.97 | 1.97 | 1.97 | 1.97 | 1.97 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 10.10 | 10.62 | 9.86 | 10.33 | 9.58 | 10.05 | 9.32 |
| | Dependability 90% | $Mm^3/yr$ | 1.89 | 1.68 | 1.70 | 1.61 | 1.62 | 1.56 | 1.57 |
| | Dependability 75% | $Mm^3/yr$ | 6.55 | 6.78 | 6.36 | 6.71 | 6.28 | 6.67 | 6.23 |
| | Dependability 50% | $Mm^3/yr$ | 14.48 | 15.48 | 14.29 | 15.09 | 13.93 | 14.62 | 13.49 |
| | Dependability 25% | $Mm^3/yr$ | 14.78 | 15.60 | 14.40 | 15.09 | 13.93 | 14.62 | 13.49 |
| Depth | ted Mean | mm/yr | 297 | 312 | 290 | 304 | 282 | 296 | 274 |
| | Dependability 90% | mm/yr | 56 | 49 | 50 | 47 | 48 | 46 | 46 |
| | Dependability 75% | mm/yr | 193 | 200 | 187 | 197 | 185 | 196 | 183 |
| | Dependability 50% | mm/yr | 426 | 455 | 420 | 444 | 410 | 430 | 397 |
| | Dependability 25% | mm/yr | 435 | 459 | 424 | 444 | 410 | 430 | 397 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in December 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/I$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 14219 | | | | | | |
| | Total | Mill.Rs. | | 48.34 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 48.34 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.45 | | | | | | |
| Average Annual Cost | Mill.Rs | 2.37 | 1.73 | 2.27 | 1.67 | 2.20 | 1.61 | 2.13 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 2.37 | 1.73 | 2.27 | 1.67 | 2.20 | 1.61 | 2.13 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 2.37 | 1.73 | 2.27 | 1.67 | 2.20 | 1.61 | 2.13 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.210 | 0.230 | 0.250 | 0.310 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Ummed Sagar Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | BHILWARA |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.21 | 0.23 | 0.25 | 0.31 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 3400 | 3400 | 3400 | 3400 | 3400 | 3400 | 3400 |
| SW On-Farm Irrigation Efficiency | % | 78.43 | 78.43 | 78.43 | 78.43 | 78.43 | 78.43 | 78.43 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.33 | 0.47 | 0.33 | 0.47 | 0.33 | 0.47 | 0.33 |
| Dependability 75% | $Mm^3/yr$ | 2.89 | 4.07 | 2.89 | 4.07 | 2.89 | 4.07 | 2.89 |
| Dependability 50% | $Mm^3/yr$ | 7.24 | 10.22 | 7.24 | 9.99 | 7.08 | 9.69 | 6.86 |
| Dependability 25% | $Mm^3/yr$ | 7.40 | 10.30 | 7.29 | 9.99 | 7.08 | 9.69 | 6.86 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.56 | 1.21 | 1.37 | 1.14 | 1.29 | 1.09 | 1.24 |
| Dependability 75% | $Mm^3/yr$ | 3.66 | 2.71 | 3.47 | 2.64 | 3.39 | 2.59 | 3.35 |
| Dependability 50% | $Mm^3/yr$ | 7.24 | 5.27 | 7.06 | 5.10 | 6.85 | 4.93 | 6.62 |
| Dependability 25% | $Mm^3/yr$ | 7.38 | 5.30 | 7.10 | 5.10 | 6.85 | 4.93 | 6.62 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.56 | 1.21 | 1.37 | 1.14 | 1.29 | 1.09 | 1.24 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 9.84 | 9.84 | 9.84 | 9.84 | 9.84 | 9.84 | 9.84 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.97 | 1.97 | 1.97 | 1.97 | 1.97 | 1.97 | 1.97 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 53.18 | 57.14 | 49.16 | 67.09 | 57.69 | 77.26 | 66.42 |
| CMLP Irrig. Intensity Dependability 90% | % | 9.68 | 10.41 | 9.40 | 9.67 | 8.71 | 9.40 | 8.46 |
| Dependability 75% | % | 35.38 | 42.80 | 37.01 | 41.08 | 35.49 | 40.81 | 35.24 |
| Dependability 50% | % | 79.43 | 98.38 | 84.41 | 93.06 | 79.81 | 90.13 | 77.29 |
| Dependability 25% | % | 81.27 | 99.41 | 85.29 | 93.30 | 80.02 | 90.37 | 77.49 |
| Weighted Mean | % | 55.22 | 67.44 | 58.03 | 63.67 | 54.75 | 61.91 | 53.23 |
| CMLP GW Use Dependability 90% | % | 82.47 | 72.15 | 80.55 | 70.89 | 79.60 | 70.06 | 78.97 |
| Dependability 75% | % | 53.97 | 38.30 | 53.36 | 38.29 | 53.27 | 37.88 | 52.91 |
| Dependability 50% | % | 43.80 | 29.12 | 45.50 | 30.84 | 46.83 | 30.76 | 46.76 |
| Dependability 25% | % | 41.29 | 27.41 | 44.13 | 29.93 | 46.11 | 29.85 | 46.04 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.33 | 0.00 | 5.33 | 0.00 | 5.33 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 2.37 | 7.06 | 2.27 | 7.00 | 2.20 | 6.95 | 2.13 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 5.33 | 0.00 | 5.33 | 0.00 | 5.33 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 2.37 | 7.06 | 2.27 | 7.00 | 2.20 | 6.95 | 2.13 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 53.18 | 57.14 | 49.16 | 67.09 | 57.69 | 77.26 | 66.42 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 7.22 | 8.20 | 7.05 | 7.98 | 6.86 | 7.76 | 6.67 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 10.10 | 10.62 | 9.86 | 10.33 | 9.58 | 10.05 | 9.32 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 65.12 | 60.43 | 4.68 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 65.12 | 60.43 | 4.68 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 369.31 | 317.70 | 51.61 |
| 5. Total Project Costs | Mill.Rs. | | 43.51 | 13.92 | 29.59 |
| 6. Project Capital Costs | Mill.Rs. | | 32.95 | 0.00 | 32.95 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 43.51 | 13.92 | 29.59 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 32.95 | 0.00 | 32.95 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 325.79 | 303.77 | 22.02 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.67 | 0.23 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 9690 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.51 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **1.67** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Vallabh Nagar Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | UDAIPUR | Name(s): | |
| Groundwater Potential Zone (PZ) | BINDER,Mavli | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 458.24 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 27.33 | Code: | |
| Present Dead Storage, $Mm^3$ | 0.49 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.32 | 0.68 | 0.68 | 0.87 | 0.87 | 0.99 | 0.99 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.17 | 0.18 | 0.18 | 0.20 | 0.20 | 0.22 | 0.22 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 6,464 | 6,464 | 6,464 | 6,464 | 6,464 | 6,464 | 6,464 |
| 2006Irrigation (Gross) | | $Mm^3/yr$ | 28.76 | | | | | | |
| 2006Irrigated Area | | ha | 3239 | | | | | | |

### III. Water Sources

| | | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | **35.94** | |
| Catchment Yield: | Mean | $Mm^3/yr$ | 22.71 | 22.71 | 22.71 | 22.71 | 22.71 | 22.71 | 22.71 |
| | Dependability 90% | $Mm^3/yr$ | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| | Dependability 75% | $Mm^3/yr$ | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| | Dependability 50% | $Mm^3/yr$ | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 |
| | Dependability 25% | $Mm^3/yr$ | 8.80 | 8.80 | 8.80 | 8.80 | 8.80 | 8.80 | 8.80 |
| | Weighted Mean | $Mm^3/yr$ | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| Losses from Reservoir | Annual | % | 14.85 | | | | | | |
| | During the Rabi Season | % | 7.26 | | | | | | |
| Reservoir Siltation | Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | | $Mm^3/yr$ | 0.06 | | | | | | |
| - Cumulated Siltation | | $Mm^3$ | | 0.60 | 0.60 | 1.80 | 1.80 | 3.00 | 3.00 |
| - Part of Siltation in Dead Storage | | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | | $Mm^3$ | 27.33 | 27.00 | 27.00 | 26.02 | 26.02 | 24.82 | 24.82 |
| Import: | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 3.71 | 3.71 | 3.71 | 3.71 | 3.71 | 3.71 | 3.71 |
| Dependability 90% | $Mm^3/yr$ | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| Dependability 75% | $Mm^3/yr$ | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 |
| Dependability 50% | $Mm^3/yr$ | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Dependability 25% | $Mm^3/yr$ | 8.16 | 8.16 | 8.16 | 8.16 | 8.16 | 8.16 | 8.16 |
| On-Farm Irrigation Efficiency | % | 22.22 | 70.00 | 22.22 | 70.00 | 22.22 | 70.00 | 22.22 |
| Off-Farm Irrigation Efficiency | % | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 | 72.00 | 54.00 |
| Present Overall Irrigation Efficiency | % | 12.00 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 2.00 | 2.67 | 2.00 | 2.67 | 2.00 | 2.67 | 2.00 |
| Dependability 90% | $Mm^3/yr$ | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.15 | 0.20 | 0.15 | 0.20 | 0.15 | 0.20 | 0.15 |
| Dependability 50% | $Mm^3/yr$ | 1.35 | 1.80 | 1.35 | 1.80 | 1.35 | 1.80 | 1.35 |
| Dependability 25% | $Mm^3/yr$ | 4.41 | 5.88 | 4.41 | 5.88 | 4.41 | 5.88 | 4.41 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 31 | 41 | 31 | 41 | 31 | 41 | 31 |
| Dependability 90% | mm/yr | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Dependability 75% | mm/yr | 2 | 3 | 2 | 3 | 2 | 3 | 2 |
| Dependability 50% | mm/yr | 21 | 28 | 21 | 28 | 21 | 28 | 21 |
| Dependability 25% | mm/yr | 68 | 91 | 68 | 91 | 68 | 91 | 68 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 61.60 | | 61.60 | | 61.60 | | 61.60 |
| Weighted Mean | $Mm^3/yr$ | 2.28 | 1.33 | 2.28 | 1.33 | 2.28 | 1.33 | 2.28 |
| Dependability 90% | $Mm^3/yr$ | 0.06 | 0.03 | 0.06 | 0.03 | 0.06 | 0.03 | 0.06 |
| Dependability 75% | $Mm^3/yr$ | 0.17 | 0.10 | 0.17 | 0.10 | 0.17 | 0.10 | 0.17 |
| Dependability 50% | $Mm^3/yr$ | 1.54 | 0.90 | 1.54 | 0.90 | 1.54 | 0.90 | 1.54 |
| Dependability 25% | $Mm^3/yr$ | 5.03 | 2.94 | 5.03 | 2.94 | 5.03 | 2.94 | 5.03 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 0.23 | 0.08 | 0.12 | 0.04 | 0.05 | 0.01 | 0.01 |
| Dependability 90% | $Mm^3/yr$ | 0.23 | 0.08 | 0.12 | 0.04 | 0.05 | 0.01 | 0.01 |
| Dependability 75% | $Mm^3/yr$ | 0.23 | 0.08 | 0.12 | 0.04 | 0.05 | 0.01 | 0.01 |
| Dependability 50% | $Mm^3/yr$ | 0.23 | 0.08 | 0.12 | 0.04 | 0.05 | 0.01 | 0.01 |
| Dependability 25% | $Mm^3/yr$ | 0.23 | 0.08 | 0.12 | 0.04 | 0.05 | 0.01 | 0.01 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 2.51 | 1.41 | 2.40 | 1.37 | 2.34 | 1.34 | 2.30 |
| Dependability 90% | $Mm^3/yr$ | 0.29 | 0.11 | 0.17 | 0.07 | 0.11 | 0.04 | 0.07 |
| Dependability 75% | $Mm^3/yr$ | 0.40 | 0.18 | 0.29 | 0.14 | 0.23 | 0.11 | 0.18 |
| Dependability 50% | $Mm^3/yr$ | 1.77 | 0.98 | 1.66 | 0.94 | 1.60 | 0.91 | 1.55 |
| Dependability 25% | $Mm^3/yr$ | 5.26 | 3.02 | 5.14 | 2.97 | 5.08 | 2.95 | 5.04 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.04 | 0.08 | 0.08 | 0.10 | 0.10 | 0.11 | 0.11 |
| Dependability 90% | $Mm^3/yr$ | 0.04 | 0.08 | 0.08 | 0.10 | 0.10 | 0.11 | 0.11 |
| Dependability 75% | $Mm^3/yr$ | 0.04 | 0.08 | 0.08 | 0.10 | 0.10 | 0.11 | 0.11 |
| Dependability 50% | $Mm^3/yr$ | 0.04 | 0.08 | 0.08 | 0.10 | 0.10 | 0.11 | 0.11 |
| Dependability 25% | $Mm^3/yr$ | 0.04 | 0.08 | 0.08 | 0.10 | 0.10 | 0.11 | 0.11 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 2.56 | 1.49 | 2.48 | 1.47 | 2.44 | 1.45 | 2.41 |
| Dependability 90% | $Mm^3/yr$ | 0.33 | 0.19 | 0.25 | 0.17 | 0.21 | 0.15 | 0.18 |
| Dependability 75% | $Mm^3/yr$ | 0.44 | 0.26 | 0.37 | 0.23 | 0.32 | 0.22 | 0.29 |
| Dependability 50% | $Mm^3/yr$ | 1.81 | 1.06 | 1.74 | 1.03 | 1.69 | 1.02 | 1.66 |
| Dependability 25% | $Mm^3/yr$ | 5.30 | 3.09 | 5.22 | 3.07 | 5.18 | 3.06 | 5.15 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 3.32 | 1.88 | 2.87 | 1.65 | 2.62 | 1.49 | 2.45 |
| Dependability 90% | $Mm^3/yr$ | 1.09 | 0.58 | 0.64 | 0.35 | 0.39 | 0.19 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 1.20 | 0.65 | 0.76 | 0.41 | 0.50 | 0.26 | 0.33 |
| Dependability 50% | $Mm^3/yr$ | 2.57 | 1.45 | 2.13 | 1.21 | 1.87 | 1.06 | 1.70 |
| Dependability 25% | $Mm^3/yr$ | 6.06 | 3.48 | 5.61 | 3.25 | 5.36 | 3.10 | 5.19 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 3.32 | 1.88 | 2.87 | 1.65 | 2.62 | 1.49 | 2.45 |
| Dependability 90% | $Mm^3/yr$ | 1.09 | 0.58 | 0.64 | 0.35 | 0.39 | 0.19 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 1.20 | 0.65 | 0.76 | 0.41 | 0.50 | 0.26 | 0.33 |
| Dependability 50% | $Mm^3/yr$ | 2.57 | 1.45 | 2.13 | 1.21 | 1.87 | 1.06 | 1.70 |
| Dependability 25% | $Mm^3/yr$ | 6.06 | 3.48 | 5.61 | 3.25 | 5.36 | 3.10 | 5.19 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 51 | 29 | 44 | 25 | 40 | 23 | 38 |
| | Dependability 90% | mm/yr | 17 | 9 | 10 | 5 | 6 | 3 | 3 |
| | Dependability 75% | mm/yr | 19 | 10 | 12 | 6 | 8 | 4 | 5 |
| | Dependability 50% | mm/yr | 40 | 22 | 33 | 19 | 29 | 16 | 26 |
| | Dependability 25% | mm/yr | 94 | 54 | 87 | 50 | 83 | 48 | 80 |
| Well Yield | | $10^3 m^3/yr$ | 11 | | | | | | |
| No. of Irrigation Wells | Existing | | 858 | 858 | 858 | 858 | 858 | 858 | 858 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 9.24 | 9.24 | 9.24 | 9.24 | 9.24 | 9.24 | 9.24 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 5.32 | 4.55 | 4.87 | 4.32 | 4.62 | 4.16 | 4.45 |
| | Dependability 90% | $Mm^3/yr$ | 1.14 | 0.65 | 0.69 | 0.41 | 0.44 | 0.26 | 0.27 |
| | Dependability 75% | $Mm^3/yr$ | 1.35 | 0.85 | 0.91 | 0.61 | 0.65 | 0.46 | 0.48 |
| | Dependability 50% | $Mm^3/yr$ | 3.93 | 3.25 | 3.48 | 3.02 | 3.23 | 2.86 | 3.06 |
| | Dependability 25% | $Mm^3/yr$ | 10.47 | 9.36 | 10.02 | 9.13 | 9.77 | 8.97 | 9.60 |
| Depth | ted Mean | mm/yr | 82 | 70 | 75 | 67 | 71 | 64 | 69 |
| | Dependability 90% | mm/yr | 18 | 10 | 11 | 6 | 7 | 4 | 4 |
| | Dependability 75% | mm/yr | 21 | 13 | 14 | 9 | 10 | 7 | 7 |
| | Dependability 50% | mm/yr | 61 | 50 | 54 | 47 | 50 | 44 | 47 |
| | Dependability 25% | mm/yr | 162 | 145 | 155 | 141 | 151 | 139 | 148 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 10353 | | | | | | |
| | Total | Mill.Rs. | | 66.92 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 66.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.50 | | | | | | |
| Average Annual Cost | Mill.Rs | 1.66 | 0.94 | 1.43 | 0.82 | 1.31 | 0.75 | 1.22 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 1.66 | 0.94 | 1.43 | 0.82 | 1.31 | 0.75 | 1.22 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 1.66 | 0.94 | 1.43 | 0.82 | 1.31 | 0.75 | 1.22 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.230 | 0.210 | 0.380 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Vallabh Nagar Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | UDAIPUR |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.23 | 0.21 | 0.38 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 6464 | 6464 | 6464 | 6464 | 6464 | 6464 | 6464 |
| SW On-Farm Irrigation Efficiency | % | 22.22 | 70.00 | 22.22 | 70.00 | 22.22 | 70.00 | 22.22 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 |
| Dependability 75% | $Mm^3/yr$ | 0.15 | 0.20 | 0.15 | 0.20 | 0.15 | 0.20 | 0.15 |
| Dependability 50% | $Mm^3/yr$ | 1.35 | 1.80 | 1.35 | 1.80 | 1.35 | 1.80 | 1.35 |
| Dependability 25% | $Mm^3/yr$ | 4.41 | 5.88 | 4.41 | 5.88 | 4.41 | 5.88 | 4.41 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 1.09 | 0.58 | 0.64 | 0.35 | 0.39 | 0.19 | 0.22 |
| Dependability 75% | $Mm^3/yr$ | 1.20 | 0.65 | 0.76 | 0.41 | 0.50 | 0.26 | 0.33 |
| Dependability 50% | $Mm^3/yr$ | 2.57 | 1.45 | 2.13 | 1.21 | 1.87 | 1.06 | 1.70 |
| Dependability 25% | $Mm^3/yr$ | 6.06 | 3.48 | 5.61 | 3.25 | 5.36 | 3.10 | 5.19 |
| Firm GW for Kharif | $Mm^3/yr$ | 1.09 | 0.58 | 0.64 | 0.35 | 0.39 | 0.19 | 0.22 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 9.24 | 9.24 | 9.24 | 9.24 | 9.24 | 9.24 | 9.24 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 20.45 | 24.65 | 17.36 | 26.44 | 18.27 | 29.31 | 19.96 |
| CMLP Irrig. Intensity Dependability 90% | % | 4.00 | 2.68 | 2.38 | 1.64 | 1.41 | 0.99 | 0.80 |
| Dependability 75% | % | 4.55 | 3.48 | 2.93 | 2.41 | 1.93 | 1.74 | 1.30 |
| Dependability 50% | % | 11.06 | 13.15 | 9.43 | 11.68 | 8.16 | 10.76 | 7.37 |
| Dependability 25% | % | 27.62 | 37.78 | 25.99 | 35.31 | 24.05 | 33.75 | 22.83 |
| Weighted Mean | % | 14.59 | 18.40 | 12.96 | 16.72 | 11.55 | 15.66 | 10.66 |
| CMLP GW Use Dependability 90% | % | 95.61 | 89.67 | 92.77 | 83.85 | 88.58 | 74.14 | 81.40 |
| Dependability 75% | % | 88.44 | 75.80 | 82.76 | 66.46 | 77.16 | 55.38 | 68.81 |
| Dependability 50% | % | 64.59 | 38.85 | 59.68 | 34.31 | 56.38 | 32.67 | 54.44 |
| Dependability 25% | % | 55.69 | 29.08 | 53.59 | 27.63 | 52.43 | 29.21 | 52.43 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 7.38 | 0.00 | 7.38 | 0.00 | 7.38 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 1.66 | 8.32 | 1.43 | 8.21 | 1.31 | 8.13 | 1.22 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 7.38 | 0.00 | 7.38 | 0.00 | 7.38 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 1.66 | 8.32 | 1.43 | 8.21 | 1.31 | 8.13 | 1.22 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 20.45 | 24.65 | 17.36 | 26.44 | 18.27 | 29.31 | 19.96 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 2.60 | 3.28 | 2.31 | 3.10 | 2.14 | 2.99 | 2.03 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 5.32 | 4.55 | 4.87 | 4.32 | 4.62 | 4.16 | 4.45 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 27.74 | 29.69 | -1.95 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 27.74 | 29.69 | -1.95 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 155.41 | 108.87 | 46.54 |
| 5. Total Project Costs | Mill.Rs. | | 51.23 | 8.66 | 42.57 |
| 6. Project Capital Costs | Mill.Rs. | | 45.61 | 0.00 | 45.61 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 51.23 | 8.66 | 42.57 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 45.61 | 0.00 | 45.61 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 104.18 | 100.21 | 3.97 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 1.85 | 0.29 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 7056 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 1.08 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **1.09** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

## Irrigation Project Planning Worksheet

(Shaded cells - for values computed by the spreadsheet and/or not for entering any data)

Project Name: **Wagon Irrigation Project**

### I. Water Resources Information System (WRIS) Data

| | | | |
|---|---|---|---|
| WRIS Project Code: | | Aquifer Category | B |
| Status: | Existing | Reference Document: | |
| River Basin: | Banas | Linked to Project(s): | |
| District | Chittor | Name(s): | |
| Groundwater Potential Zone (PZ) | Bari Sadri,Bhadesar,Dungla | Code(s): | |
| Unintercepted Catchment Area, $km^2$ | 256 | Conditional on Project: | |
| Present Live Storage, $Mm^3$ | 37.06 | Code: | |
| Present Dead Storage, $Mm^3$ | 2.55 | Name: | |

### II. Priority Water Demands (inside the project command area), Gross

(irrigation demand is computed by the CMLP model)

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Cities | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Towns | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Villages | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.54 | 1.08 | 1.08 | 1.30 | 1.30 | 1.43 | 1.43 |
| Industries, Power Plants | From SW | $Mm^3/yr$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Livestock | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | 0.54 | 0.57 | 0.57 | 0.64 | 0.64 | 0.72 | 0.72 |
| Other | From SW | $Mm^3/yr$ | | | | | | | |
| | From GW | $Mm^3/yr$ | | | | | | | |
| Commited SW Export | | $Mm^3/yr$ | | | | | | | |
| Cultivable Command Area (CCA) | | ha | 8,270 | 8,270 | 8,270 | 8,270 | 8,270 | 8,270 | 8,270 |
| 2005Irrigation (Gross) | | $Mm^3/yr$ | 12.84 | | | | | | |
| 2005Irrigated Area | | ha | 1717 | | | | | | |

### III. Water Sources

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Surface Water** | | | | | | | | |
| Catchment Yield: Mean | $Mm^3/yr$ | 30.43 | 30.43 | 30.43 | 30.43 | 30.43 | 30.43 | 30.43 |
| Dependability 90% | $Mm^3/yr$ | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Dependability 75% | $Mm^3/yr$ | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 |
| Dependability 50% | $Mm^3/yr$ | 24.10 | 24.10 | 24.10 | 24.10 | 24.10 | 24.10 | 24.10 |
| Dependability 25% | $Mm^3/yr$ | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 |
| Weighted Mean | $Mm^3/yr$ | 23.08 | 23.08 | 23.08 | 23.08 | 23.08 | 23.08 | 23.08 |
| Losses from Reservoir Annual | % | 21.16 | | | | | | |
| During the Rabi Season | % | 10.17 | | | | | | |
| Reservoir Siltation Per km | $m^3/yr$ | 131.00 | | | | | | |
| - Catchment Total | $Mm^3/yr$ | 0.03 | | | | | | |
| - Cumulated Siltation | $Mm^3$ | | 0.34 | 0.34 | 1.01 | 1.01 | 1.68 | 1.68 |
| - Part of Siltation in Dead Storage | % | 45 | | | | | | |
| Effective Storage (or Lift Capacity) | $Mm^3$ | 37.06 | 36.88 | 36.88 | 36.51 | 36.51 | 36.14 | 36.14 |
| Import: Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Total SW for Irrigation: Weighted Mean | $Mm^3/yr$ | 18.82 | 18.76 | 18.76 | 18.64 | 18.64 | 18.52 | 18.52 |
| Dependability 90% | $Mm^3/yr$ | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 |
| Dependability 75% | $Mm^3/yr$ | 4.31 | 4.31 | 4.31 | 4.31 | 4.31 | 4.31 | 4.31 |
| Dependability 50% | $Mm^3/yr$ | 21.65 | 21.65 | 21.65 | 21.65 | 21.65 | 21.65 | 21.65 |
| Dependability 25% | $Mm^3/yr$ | 33.29 | 33.13 | 33.13 | 32.79 | 32.79 | 32.46 | 32.46 |
| On-Farm Irrigation Efficiency | % | 57.03 | 70.00 | 57.03 | 70.00 | 57.03 | 70.00 | 57.03 |
| Off-Farm Irrigation Efficiency | % | 30.37 | 72.00 | 30.37 | 72.00 | 30.37 | 72.00 | 30.37 |
| Present Overall Irrigation Efficiency | % | 17.32 | | | | | | |
| Gross SW on Farm:Weighted Mean | $Mm^3/yr$ | 5.71 | 13.50 | 5.70 | 13.42 | 5.66 | 13.33 | 5.62 |
| Dependability 90% | $Mm^3/yr$ | 0.57 | 1.36 | 0.57 | 1.36 | 0.57 | 1.36 | 0.57 |
| Dependability 75% | $Mm^3/yr$ | 1.31 | 3.10 | 1.31 | 3.10 | 1.31 | 3.10 | 1.31 |
| Dependability 50% | $Mm^3/yr$ | 6.57 | 15.59 | 6.57 | 15.59 | 6.57 | 15.59 | 6.57 |
| Dependability 25% | $Mm^3/yr$ | 10.11 | 23.85 | 10.06 | 23.61 | 9.96 | 23.37 | 9.86 |
| Gross On-Farm Irrig. Depth:Wtd. Mean | mm/yr | 69 | 163 | 69 | 162 | 68 | 161 | 68 |
| Dependability 90% | mm/yr | 7 | 16 | 7 | 16 | 7 | 16 | 7 |
| Dependability 75% | mm/yr | 16 | 38 | 16 | 38 | 16 | 38 | 16 |
| Dependability 50% | mm/yr | 80 | 188 | 80 | 188 | 80 | 188 | 80 |
| Dependability 25% | mm/yr | 122 | 288 | 122 | 286 | 120 | 283 | 119 |
| Peak Month Supply Capacity | % | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | $Mm^3/mo$ | 8.32 | 8.28 | 8.28 | 8.20 | 8.20 | 8.12 | 8.12 |
| Pump Discharge( | $m^3/s$ | | | 0.00 | | 0.00 | | 0.00 |
| Head | m | | | 0.00 | | 0.00 | | 0.00 |
| Hours per Year | | | | 0.00 | | 0.00 | | 0.00 |
| Discharge Main Length | km | | | 0.00 | | 0.00 | | 0.00 |
| Surplus Catchment Yield: Wtd. Mean | $Mm^3/yr$ | 2.14 | 2.20 | 2.20 | 2.34 | 2.34 | 2.47 | 2.47 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 5.94 | 6.12 | 6.12 | 6.49 | 6.49 | 6.86 | 6.86 |
| Possible Domestic+Livestock Wtd Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Industrial WS:Weighted. Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Possible Other Supplies: Weighted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 75% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 50% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 25% | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **b. Groundwater** | | | | | | | | |
| Normalised Natural Replenishment | $Mm^3/yr$ | 4.53 | 4.53 | 4.53 | 4.53 | 4.53 | 4.53 | 4.53 |
| Mining Potential | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Artificial Recharge ıted Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dependability 90% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 75% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 50% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Dependability 25% | $Mm^3/yr$ | | | 0.00 | | 0.00 | | 0.00 |
| Return Flows - SW Irrigation: On Farm | % | | 25.00 | | 25.00 | | 25.00 | |
| Off Farm | % | | 18.00 | | 18.00 | | 18.00 | |
| Combined, at present | % | 57.88 | | 57.88 | | 57.88 | | 57.88 |
| Weighted Mean | $Mm^3/yr$ | 10.89 | 6.75 | 10.86 | 6.71 | 10.79 | 6.67 | 10.72 |
| Dependability 90% | $Mm^3/yr$ | 1.09 | 0.68 | 1.09 | 0.68 | 1.09 | 0.68 | 1.09 |
| Dependability 75% | $Mm^3/yr$ | 2.50 | 1.55 | 2.50 | 1.55 | 2.50 | 1.55 | 2.50 |
| Dependability 50% | $Mm^3/yr$ | 12.53 | 7.79 | 12.53 | 7.79 | 12.53 | 7.79 | 12.53 |
| Dependability 25% | $Mm^3/yr$ | 19.27 | 11.93 | 19.17 | 11.81 | 18.98 | 11.69 | 18.79 |
| Return Flows - GW Irrigation: On Farm | % | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 | 20.00 | 30.00 |
| Weighted Mean | $Mm^3/yr$ | 1.04 | 0.58 | 0.86 | 0.52 | 0.78 | 0.48 | 0.71 |
| Dependability 90% | $Mm^3/yr$ | 1.04 | 0.58 | 0.86 | 0.52 | 0.78 | 0.48 | 0.71 |
| Dependability 75% | $Mm^3/yr$ | 1.04 | 0.58 | 0.86 | 0.52 | 0.78 | 0.48 | 0.71 |
| Dependability 50% | $Mm^3/yr$ | 1.04 | 0.58 | 0.86 | 0.52 | 0.78 | 0.48 | 0.71 |
| Dependability 25% | $Mm^3/yr$ | 1.04 | 0.58 | 0.86 | 0.52 | 0.78 | 0.48 | 0.71 |
| Total Irrigation Return Flows: Wtd.Mean | $Mm^3/yr$ | 11.92 | 7.33 | 11.72 | 7.23 | 11.56 | 7.14 | 11.43 |
| Dependability 90% | $Mm^3/yr$ | 2.13 | 1.26 | 1.96 | 1.20 | 1.87 | 1.16 | 1.81 |
| Dependability 75% | $Mm^3/yr$ | 3.53 | 2.13 | 3.36 | 2.07 | 3.27 | 2.03 | 3.21 |
| Dependability 50% | $Mm^3/yr$ | 13.56 | 8.37 | 13.39 | 8.31 | 13.31 | 8.27 | 13.24 |
| Dependability 25% | $Mm^3/yr$ | 20.30 | 12.50 | 20.04 | 12.32 | 19.76 | 12.16 | 19.50 |
| Return Flows from Domestic WS | | | | | | | | |
| - Cities and Towns | % | 30 | 28 | 28 | 24 | 24 | 20 | 20 |
| - Villages | % | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| - Total ıted Mean | $Mm^3/yr$ | 0.10 | 0.15 | 0.15 | 0.18 | 0.18 | 0.20 | 0.20 |
| Dependability 90% | $Mm^3/yr$ | 0.10 | 0.15 | 0.15 | 0.18 | 0.18 | 0.20 | 0.20 |
| Dependability 75% | $Mm^3/yr$ | 0.10 | 0.15 | 0.15 | 0.18 | 0.18 | 0.20 | 0.20 |
| Dependability 50% | $Mm^3/yr$ | 0.10 | 0.15 | 0.15 | 0.18 | 0.18 | 0.20 | 0.20 |
| Dependability 25% | $Mm^3/yr$ | 0.10 | 0.15 | 0.15 | 0.18 | 0.18 | 0.20 | 0.20 |
| Total Return Flows: ıted Mean | $Mm^3/yr$ | 12.02 | 7.48 | 11.87 | 7.40 | 11.74 | 7.34 | 11.63 |
| Dependability 90% | $Mm^3/yr$ | 2.22 | 1.41 | 2.11 | 1.37 | 2.05 | 1.35 | 2.00 |
| Dependability 75% | $Mm^3/yr$ | 3.63 | 2.28 | 3.51 | 2.25 | 3.45 | 2.22 | 3.40 |
| Dependability 50% | $Mm^3/yr$ | 13.66 | 8.52 | 13.54 | 8.49 | 13.48 | 8.47 | 13.44 |
| Dependability 25% | $Mm^3/yr$ | 20.40 | 12.65 | 20.19 | 12.50 | 19.93 | 12.36 | 19.70 |
| Total Available GW : Wwighted Mean | $Mm^3/yr$ | 15.47 | 10.36 | 14.75 | 9.99 | 14.33 | 9.72 | 14.01 |
| Dependability 90% | $Mm^3/yr$ | 5.67 | 4.29 | 4.99 | 3.96 | 4.64 | 3.73 | 4.38 |
| Dependability 75% | $Mm^3/yr$ | 7.08 | 5.16 | 6.39 | 4.84 | 6.04 | 4.60 | 5.78 |
| Dependability 50% | $Mm^3/yr$ | 17.11 | 11.40 | 16.42 | 11.08 | 16.07 | 10.85 | 15.82 |
| Dependability 25% | $Mm^3/yr$ | 23.85 | 15.53 | 23.07 | 15.09 | 22.52 | 14.74 | 22.08 |
| Total Usable GW for Irrig: Wtd. Mean | $Mm^3/yr$ | 15.47 | 10.36 | 14.75 | 9.99 | 14.33 | 9.72 | 14.01 |
| Dependability 90% | $Mm^3/yr$ | 5.67 | 4.29 | 4.99 | 3.96 | 4.64 | 3.73 | 4.38 |
| Dependability 75% | $Mm^3/yr$ | 7.08 | 5.16 | 6.39 | 4.84 | 6.04 | 4.60 | 5.78 |
| Dependability 50% | $Mm^3/yr$ | 17.11 | 11.40 | 16.42 | 11.08 | 16.07 | 10.85 | 15.82 |
| Dependability 25% | $Mm^3/yr$ | 23.85 | 15.53 | 23.07 | 15.09 | 22.52 | 14.74 | 22.08 |

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| On-Farm GW Irrig. Depth: | Wtd. Mean | mm/yr | 187 | 125 | 178 | 121 | 173 | 118 | 169 |
| | Dependability 90% | mm/yr | 69 | 52 | 60 | 48 | 56 | 45 | 53 |
| | Dependability 75% | mm/yr | 86 | 62 | 77 | 58 | 73 | 56 | 70 |
| | Dependability 50% | mm/yr | 207 | 138 | 199 | 134 | 194 | 131 | 191 |
| | Dependability 25% | mm/yr | 288 | 188 | 279 | 182 | 272 | 178 | 267 |
| Well Yield | | $10^3 m^3/yr$ | 14 | | | | | | |
| No. of Irrigation Wells | Existing | | 2186 | 2187 | 2186 | 2187 | 2186 | 2187 | 2186 |
| | Additional | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Max Annual Supply Capaciy | | $Mm^3/yr$ | 30.95 | 30.97 | 30.95 | 30.97 | 30.95 | 30.97 | 30.95 |
| Peak Month Supply Capaciy | | % | 20 | | | | | | |
| | | $Mm^3/mo$ | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 |
| Area to be Drained | | ha | | | | | | | |

**c. Total Water Available for Irrigation, On Farm**

| | | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Amount | ted Mean | $Mm^3/yr$ | 21.19 | 23.86 | 20.45 | 23.41 | 19.99 | 23.05 | 19.63 |
| | Dependability 90% | $Mm^3/yr$ | 6.25 | 5.64 | 5.56 | 5.32 | 5.21 | 5.09 | 4.95 |
| | Dependability 75% | $Mm^3/yr$ | 8.39 | 8.26 | 7.70 | 7.94 | 7.35 | 7.71 | 7.09 |
| | Dependability 50% | $Mm^3/yr$ | 23.69 | 26.99 | 23.00 | 26.67 | 22.65 | 26.43 | 22.39 |
| | Dependability 25% | $Mm^3/yr$ | 33.96 | 39.38 | 33.13 | 38.70 | 32.48 | 38.11 | 31.94 |
| Depth | ted Mean | mm/yr | 256 | 289 | 247 | 283 | 242 | 279 | 237 |
| | Dependability 90% | mm/yr | 76 | 68 | 67 | 64 | 63 | 62 | 60 |
| | Dependability 75% | mm/yr | 101 | 100 | 93 | 96 | 89 | 93 | 86 |
| | Dependability 50% | mm/yr | 286 | 326 | 278 | 322 | 274 | 320 | 271 |
| | Dependability 25% | mm/yr | 411 | 476 | 401 | 468 | 393 | 461 | 386 |

**IV. Reclaimable Sewage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| From Towns + Cities in the GCA | | % | 5 | 20 | 20 | 35 | 35 | 60 | 60 |
| | Mean | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Annual Irrigation Depth | mm | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**V. Investments and Costs** (in 2010 terms)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investments | | | | | | | | | |
| 1. New Civil Works | | Mill.Rs. | | | | | | | |
| 2. Civil Works Rehabilitation | | Mill.Rs. | | | | | | | |
| 3. Pumping Equip.- per $m^3/s/m$ (head) | | $10^3$ Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 4. Discharge Main | Per $m^3/sec/l$ | Mill.Rs. | | | | | | | |
| | - Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 5. Irrigation Systems | | | | | | | | | |
| - Improvement | Per ha | Rs. | 9639 | | | | | | |
| | Total | Mill.Rs. | | 79.71 | | | | | |
| - New Areas | Per ha | Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| 7. Well Construction | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8. Pumps for wells | Per Well | $10^3$ Rs. | | | | | | | |
| | Total | Mill.Rs. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9. Pumps on canals | Total | Mill.Rs. | 0 | 0 | | 0 | | 0 | |
| 10. Drainage System | Per ha | Mill.Rs. | | | | | | | |
| | Total | Mill.Rs. | | 0.00 | | 0.00 | | 0.00 | |
| Total Investment Cost | | Mill.Rs. | 0.00 | 79.71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| | Depreciation Period | | | Construction Period (for economic study) | | | | |
| - Storage and Other Civil Works | Years | 100 | | 3 | | | | |
| - Irrigation Systems, Dug Wells etc. | Years | 100 | | 3 | | | | |
| - Tube Wells, Pumps, Accessories | Years | 25 | | 3 | | | | |
| - Drainage Works | Years | 100 | | 3 | | | | |
| Annual O&M Costs on New Civil Works | | | | | | | | |
| - Percentage of Investment | % | 1.00 | | | | | | |
| Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual O&M Costs on New CCA | Rs./ha | | | | | | | |
| | Mill.Rs | | 0.00 | | 0.00 | | 0.00 | |
| Annual O&M Costs of Pumps | % | 5 | | | | | | |
| Annual Cost | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual Energy Costs (Based on wtd. mean) | | | | | | | | |
| Groundwater Pumping (for irrigation) | Rs./$m^3$ | 0.53 | | | | | | |
| Average Annual Cost | Mill.Rs | 8.20 | 5.49 | 7.82 | 5.30 | 7.59 | 5.15 | 7.42 |
| SW Pumping (for irrigation only) | Rs./$m^3$ | 0.00 | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pumping from canals (for irrigation) | | | | | | | | |
| Average Annual Cost | Mill.Rs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Average Energy Cost | Mill.Rs | 8.20 | 5.49 | 7.82 | 5.30 | 7.59 | 5.15 | 7.42 |
| Additional Annual Costs | Mill.Rs | | | | | | | |
| Total O&M Cost (excl. capital costs) | Mill.Rs | 8.20 | 5.49 | 7.82 | 5.30 | 7.59 | 5.15 | 7.42 |

| **VI Implementation** | |
|---|---|
| Earliest Possible Completion Year | 2014 |
| Latest Planned Completion Year | 2060 |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.180 | 0.200 | 0.260 | 0.360 |

% Increase over weighted mean available GW for estimating additional wells = 30

CCA = Cultivable Command Area
CMLP = Crop Mix Linear Programming
GCA = Geographical Command Area
GW = Ground Water
IDZ = Irrigation demand Zone
SW = Surface Water
WS = Water Supply

## VII. Irrigation Project Planning Worksheet - CMLP Extract

| | |
|---|---|
| Project name: | Wagon Irrigation Project |
| WRIS Project Code: | 0 |
| Status: | Existing |
| River Basin: | Banas |
| Irrigation Demand Zone (IDZ) | Chittor |
| Aquifer regulation: | No |

Weights of Dependability Levels

| Dependability, % | 90 | 75 | 50 | 25 |
|---|---|---|---|---|
| Weight | 0.18 | 0.2 | 0.26 | 0.36 |

| | Unit | 2010 | 2020 | | 2040 | | 2060 | |
|---|---|---|---|---|---|---|---|---|
| | | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| **a. Input to CMLP** | | | | | | | | |
| Cultivable Command Area (CCA) | ha | 8270 | 8270 | 8270 | 8270 | 8270 | 8270 | 8270 |
| SW On-Farm Irrigation Efficiency | % | 57.03 | 70.00 | 57.03 | 70.00 | 57.03 | 70.00 | 57.03 |
| GW On-Farm Irrigation Efficiency | % | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 | 75.00 | 65.00 |
| Gross SW on Farm Dependability 90% | $Mm^3/yr$ | 0.57 | 1.36 | 0.57 | 1.36 | 0.57 | 1.36 | 0.57 |
| Dependability 75% | $Mm^3/yr$ | 1.31 | 3.10 | 1.31 | 3.10 | 1.31 | 3.10 | 1.31 |
| Dependability 50% | $Mm^3/yr$ | 6.57 | 15.59 | 6.57 | 15.59 | 6.57 | 15.59 | 6.57 |
| Dependability 25% | $Mm^3/yr$ | 10.11 | 23.85 | 10.06 | 23.61 | 9.96 | 23.37 | 9.86 |
| Total Available GW | | | | | | | | |
| Dependability 90% | $Mm^3/yr$ | 5.67 | 4.29 | 4.99 | 3.96 | 4.64 | 3.73 | 4.38 |
| Dependability 75% | $Mm^3/yr$ | 7.08 | 5.16 | 6.39 | 4.84 | 6.04 | 4.60 | 5.78 |
| Dependability 50% | $Mm^3/yr$ | 17.11 | 11.40 | 16.42 | 11.08 | 16.07 | 10.85 | 15.82 |
| Dependability 25% | $Mm^3/yr$ | 23.85 | 15.53 | 23.07 | 15.09 | 22.52 | 14.74 | 22.08 |
| Firm GW for Kharif | $Mm^3/yr$ | 5.67 | 4.29 | 4.99 | 3.96 | 4.64 | 3.73 | 4.38 |
| Weighted Mean multi annual GW Supply | $Mm^3/yr$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Max.Annual Pumping Supply Capacity | $Mm^3/yr$ | 30.95 | 30.97 | 30.95 | 30.97 | 30.95 | 30.97 | 30.95 |
| Peak Month GW Supply Capaciy | $Mm^3/mo.$ | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 | 6.19 |
| **b. CMLP Results** | | | | | | | | |
| CMLP-Weighted mean irrigation benefit | Mill.Rs/yr | 85.36 | 113.97 | 84.94 | 131.26 | 97.47 | 146.88 | 108.78 |
| CMLP Irrig. Intensity Dependability 90% | % | 14.78 | 15.52 | 13.30 | 14.52 | 12.35 | 13.87 | 11.74 |
| Dependability 75% | % | 19.73 | 22.57 | 18.31 | 21.52 | 17.33 | 20.87 | 16.72 |
| Dependability 50% | % | 55.12 | 73.05 | 54.15 | 71.63 | 52.91 | 70.98 | 52.30 |
| Dependability 25% | % | 79.08 | 106.75 | 78.08 | 104.12 | 75.98 | 102.50 | 74.68 |
| Weighted Mean | % | 49.41 | 64.73 | 48.24 | 63.02 | 46.80 | 62.03 | 45.94 |
| CMLP GW Use Dependability 90% | % | 90.83 | 75.93 | 89.69 | 74.48 | 88.99 | 73.31 | 88.43 |
| Dependability 75% | % | 84.26 | 61.52 | 82.83 | 59.95 | 81.99 | 58.73 | 81.33 |
| Dependability 50% | % | 70.47 | 37.43 | 69.70 | 36.70 | 67.98 | 36.14 | 68.86 |
| Dependability 25% | % | 67.84 | 33.45 | 67.39 | 33.00 | 67.08 | 32.64 | 66.85 |

## VIII. Data for Present Value Assessment

| Period | Investment Completed | Operation From | Operation Up To | Lngth (yrs) | Start (yrs) |
|---|---|---|---|---|---|
| 2010 | | 2010 | 2015 | 5 | 0 |
| 2020 | 2015 | 2015 | 2030 | 15 | 5 |
| 2040 | 2030 | 2030 | 2050 | 20 | 20 |
| 2060 | 2050 | 2050 | 2070 | 20 | 40 |

| | |
|---|---|
| Rate of Interest: | 10.00% |

| IX. Annual Cost and Benefits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | | 2040 | | 2060 | |
| | Unit | | With Plan | Without Plan | With Plan | Without Plan | With Plan | Without Plan |
| Annuity Capital Cost | Mill.Rs./yr | 0.00 | 8.80 | 0.00 | 8.80 | 0.00 | 8.80 | 0.00 |
| Annuity Total Project Cost | Mill.Rs./yr | 8.20 | 14.29 | 7.82 | 14.09 | 7.59 | 13.95 | 7.42 |
| Irrigation allocated Annuity Capital Cost | Mill.Rs./yr | 0.00 | 8.80 | 0.00 | 8.80 | 0.00 | 8.80 | 0.00 |
| Irrigation allocated Annuity Project Cost | Mill.Rs./yr | 8.20 | 14.29 | 7.82 | 14.09 | 7.59 | 13.95 | 7.42 |
| Wtd. Mean Irrigation Benefit | Mill.Rs./yr | 85.36 | 113.97 | 84.94 | 131.26 | 97.47 | 146.88 | 108.78 |
| Wtd.Mean net Irrigation water supply | $Mm^3/yr$ | 13.32 | 17.22 | 12.84 | 16.89 | 12.54 | 16.62 | 12.31 |
| Wtd.Mean gross Irrigation WS on farm | $Mm^3/yr$ | 21.19 | 23.86 | 20.45 | 23.41 | 19.99 | 23.05 | 19.63 |
| Wtd Mean Surface WS to Priority Sectors | $Mm^3/yr$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| X. Present Value | | | | | |
|---|---|---|---|---|---|
| | Unit | | With Plan | Without Plan | Difference |
| 1. Total water Supply from Project | $Mm^3$ | | 146.66 | 125.55 | 21.11 |
| 2. Gross on farm Irrigation Supply | $Mm^3$ | | 146.66 | 125.55 | 21.11 |
| 3. Water Supply to Priority Sectors | $Mm^3$ | | 0.00 | 0.00 | 0.00 |
| 4. Weighted mean Irrigation Benefits | Mill.Rs. | | 732.01 | 544.94 | 187.06 |
| 5. Total Project Costs | Mill.Rs. | | 87.92 | 47.93 | 40.00 |
| 6. Project Capital Costs | Mill.Rs. | | 54.33 | 0.00 | 54.33 |
| 7. Irrigation allocated Project Costs | Mill.Rs. | | 87.92 | 47.93 | 40.00 |
| 8. Irrigation allocated Capital Costs | Mill.Rs. | | 54.33 | 0.00 | 54.33 |
| 9. Irrigation Net Present Value (NPV) | Mill.Rs. | | 644.08 | 497.02 | 147.06 |
| **XI. Economic Indicators** | | | | | |
| 1. Total Proj. Cost/ Unit of Water Supply | $Rs./m^3$ | | 0.60 | 0.38 | |
| 2. Priority Sectors Use | % | | 0.00 | 0.00 | |
| 3.Irrig. allocated Capital Costs/ ha.CCA | Rs/ha | | 6569 | | |
| 4.Irrig. Benefits/Total Irrig.costs(B/C) | - | | 2.67 | | |
| **5.(Irrig.Benefits-O&M)/Capital costs** | | | **3.71** | | |

Notes: -Annuity Capital Cost is the annuity equivalent (using capital recovery factor) of investments, considering the construction period and period of operation.

# EXISTING PROJECTS IDENTIFIED FOR REHABILITATION

| S.No. | Project | Type | Basin | District | CCA, ha | Live Storage, MCM |
|---|---|---|---|---|---|---|
| 1 | Anwar Dam | Medium | Banas | Bhilwara | 7,394 | 47.80 |
| 2 | Badgaon | Medium | Banas | Chittaurgarh | 6,797 | 30.19 |
| 3 | Bagolia | Medium | Banas | Udaipur | 3,676 | 18.85 |
| 4 | Bassi | Medium | Banas | Chittaurgarh | 3,250 | 20.25 |
| 5 | Bhupalsagar | Medium | Banas | Chittaurgarh | 3,893 | 18.42 |
| 6 | Bilas Dam | Medium | Chambal | Baran | 5,863 | 26.76 |
| 7 | Chandra Bhaga | Medium | Banas | Bhilwara | 3,342 | 9.85 |
| 8 | Chandsen Bhieru Sagar | Medium | Banas | Tonk | 2,597 | 14.55 |
| 9 | Chhaparwada | Major | Banas | Jaipur | 11,741 | 53.20 |
| 10 | Dheel | Medium | Banas | Sawai Madhopur | 5,963 | 27.73 |
| 11 | Dindoli | Medium | Banas | Chittaurgarh | 2,056 | 7.45 |
| 12 | Dugari | Medium | Chambal | Bundi | 2,253 | 18.08 |
| 13 | Galwania | Medium | Chambal | Tonk | 2,257 | 11.39 |
| 14 | Gopalpura | Medium | Chambal | Baran | 3,357 | 32.01 |
| 15 | Jaisamand | Major | Mahi | Udaipur | 16,000 | 296.10 |
| 16 | Jakham | Major | Mahi | Pratapgarh | 28,308 | 132.28 |
| 17 | Kalisil | Medium | Banas | Karauli | 4,700 | 37.25 |
| 18 | Khari Dam | Medium | Banas | Bhilwara | 6,478 | 33.30 |
| 19 | Kothari Dam | Medium | Banas | Bhilwara | 4,395 | 21.52 |
| 20 | Lasaria Irigati on Project | Medium | Banas | Ajmer | 2,080 | 30.65 |
| 21 | Madho Sagar | Medium | Banganga | Deusa | 3,232 | 22.50 |
| 22 | Mahi Bajaj Sagar | Major | Mahi | Banswara | 80,000 | 1,833.72 |
| 23 | Mataji Ka Khera | Medium | Banas | Rajsamand | 3,057 | 11.07 |
| 24 | Meja | Major | Banas | Bhilwara | 20,714 | 83.55 |
| 25 | Murlia | Medium | Banas | Chittaurgarh | 1,323 | 8.47 |
| 26 | Narayan Sagar Irrigation | Medium | Banas | Ajmer | 4,087 | 39.82 |
| 27 | Rajsamand | Major | Banas | Rajsamand | 10,450 | 98.50 |
| 28 | Sardar Samand | Major | Luni | Pali | 10,325 | 88.23 |
| 29 | Sareri Dam | Medium | Banas | Bhilwara | 9,717 | 55.10 |
| 30 | Som Kagdar | Medium | Mahi | Udaipur | 5,739 | 34.44 |
| 31 | Tordi Sagar | Major | Banas | Tonk | 13,960 | 47.12 |
| 32 | Udai Sagar | Medium | Banas | Udaipur | 4,650 | 27.59 |
| 33 | Umme d Sagar | Medium | Chambal | Baran | 2,968 | 18.60 |
| 34 | Vallabhnagar | Medium | Banas | Udaipur | 6,465 | 28.78 |
| 35 | Wagon Project | Medium | Banas | Chittaurgarh | 8,270 | 37.58 |

| CODE | AGRO-CLIMATIC ZONE |
|---|---|
| Ia | Arid Western Plain |
| Ib | Irrigated North-Western Plains |
| Ic | Hyper-Arid and Irrigated Western Plain Partially |
| IIa | Transitional Plain of Inland Drainage |
| IIb | Transitional Plain of Luni Basin |
| IIIa | Semi-Arid Eastern Plain |
| IIIb | Flood-Prone Eastern Plains |
| IVa | Sub-Humid Southern Plains and the Aravalli Hills |
| IVb | Humid Southern Plains |
| V | Humid South- Eastern Plains |

## Legend

### Irrigation Projects

- Major
- Medium
- River flow direction

### Boundaries

- International
- State
- ACZ
- Basin
- District
- Block
- Command Area

**Labels**

COUNTRY
State
DISTRICT
ACZ
River Basin
Irrigation Project

0 20 40 80 120 160 Km

**GOVERNMENT OF RAJASTHAN**
WATER RESOURCES PLANNING DEPARTMENT
PLANNING OF WATER RESOURCES OF RAJASTHAN

**TAHAL Consulting Engineers Ltd.**

**in association with**
**WAPCOS and INRM Consultants Pvt. Ltd.**

SCALE: 1:1,500,000 | DATE: JUNE, 2014